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# REPORT

ON THE

## WATERS OF NORTH CAROLINA,

WITH REFERENCE TO THEIR POSSIBILITIES FOR

## OYSTER CULTURE;

TOGETHER WITH THE RESULTS OBTAINED BY THE SURVEYS  
DIRECTED BY THE RESOLUTION OF THE GENERAL  
ASSEMBLY, RATIFIED MARCH 11, 1885.

BY

LIEUTENANT FRANCIS WINSLOW,  
UNITED STATES NAVY.

RALEIGH:

P. M. HALE, STATE PRINTER AND BINDER,  
PRESSES OF E. M. UZZELL.  
1886.





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NORTH CAROLINA,  
DEPARTMENT OF AGRICULTURE,  
RALEIGH, N. C., Jan. 1, 1887.

*To His Excellency the Hon. A. M. SCALES,  
Governor of North Carolina:*

SIR: I have the honor to submit herewith a report on the waters of North Carolina with reference to the cultivation of oysters, together with the results of the survey of the oyster beds, so far as it has progressed.

The first portion of the report contains a detailed description of the methods employed and of the ground examined.

The second portion comprises a summary of the results and information obtained, together with certain recommendations based upon the experiences of other States and countries, to which I respectfully call your particular attention.

With the hope that the matter contained in the report will prove both of interest and value to the people of North Carolina, I am,

Very respectfully,

Your obedient servant,

FRANCIS WINSLOW,  
*Lieutenant U. S. Navy.*





## PREFACE.

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The survey of the oyster beds of North Carolina has been prosecuted by the Department of Agriculture under authority of the following resolution of the General Assembly:

### RESOLUTION IN REGARD TO THE OYSTER INDUSTRY OF THE STATE.

PREAMBLE. *Whereas*, It is necessary for the furtherance of the oyster interest of this State that the areas and positions of the natural oyster beds and private oyster gardens should be accurately known and located; *And, whereas*, It is probable that a better knowledge of the present condition of our shell fish industries would conduce to the future benefit of the people of the State; therefore, be it

*Resolved*, That the State Board of Agriculture shall cause to be made a survey of said natural oyster beds and private oyster gardens, together with an examination of the waters of the State with reference to the possibilities for the culture of shell fish, and shall report upon the same to the next session of the General Assembly of North Carolina. And his Excellency, the Governor, is hereby requested to ask the Federal Government to detail some person of the public service who is an expert in these matters, to make the necessary surveys: *Provided*, That the expenses entailed by this resolution shall be in the discretion of the Board of Agriculture.

Ratified this the 11th day of March, 1885.

My own connection with this examination by the State is sufficiently explained by the resolution, I having been directed by the Hon. Secretary of the Navy to render his Excellency, the Governor, such assistance as was in my power.

Subsequently, when the Superintendent of the U. S. Coast and Geodetic Survey determined to put a party in the field to co-operate with the authorities of the State, I was assigned to the charge of that party and command of the vessel detailed, in addition to my other duties. Having thus had the direction of all operations, I have been enabled to so co-relate them that the survey has been accomplished at a very moderate expense, the entire cost to the State on December 1st, having been but \$1,914.84. This could not have been accomplished, however, had not the valuable assistance of the Coast Survey been secured; and the State is under great obligations to Mr. F. M. Thorn, the Superintendent of that Survey, for his cordial and valuable co-operation in the work.

I am also greatly indebted to the Johns Hopkins University for the loan of their steam launch, which has been of great service, and which was furnished without charge.

To Mr. John W. Evans, Clerk of the Superior Court of Dare County; to Mr. J. H. Wahab, Clerk of the Superior Court, and Mr. Alexander Berry, Register of Deeds, of Hyde County; to Mr. John D. Davis, Clerk of the Superior Court of Carteret County, and to Mr. A. C. Huggins, Clerk of the Superior Court of Onslow County, I am not only under obligations for many courtesies shown me personally, but also for the very liberal reductions they have made in their fees for furnishing copies of the oyster licenses on file in their offices.

I am indebted for courtesies and assistance to so many other citizens of the seaboard counties that their very number prevents my mentioning them more particularly; but their many kindnesses to me and those associated with me in the work, and the very valuable assistance they have frequently rendered the Survey, is none the less appreciated and remembered. To my companions and subordinates on board the Scoresby, to whose industry is owing the large amount of work accomplished, and especially to Ensign Jas. C. Drake, U. S. Navy, Assistant U. S. C. and G. Survey, to whose zeal and good judgment much of our success is due, I am under obligations which no one but



myself can appreciate, and to which I now take great pleasure in testifying.

The preparation of the report was deferred until the last possible moment in order that it might be based upon as full information as could be obtained. The collection and arrangement of the field notes has, therefore, been somewhat hurried, and it is possible that some few errors of figures or statements may be found in the following pages. Important calculations and features have all been verified, however, and the general accuracy of the determinations may be relied upon.

The results of the examination, so far as it has progressed, are given in the following pages. Had not the season been unusually inclement and unhealthy, much more would have been accomplished; but enough has been achieved to justify every assertion made in the body of the report, and to furnish reliable data for those who wish to engage in oyster culture. It was with the hope that many would be induced to enter into such enterprises that much of what follows has been written. And if extensive oyster culture can be made an accomplished fact in the waters of North Carolina, the object, both of the Survey and of this report, will have been accomplished.

FRANCIS WINSLOW,

*Lieutenant U. S. N.*





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REPORT

ON THE

WATERS OF NORTH CAROLINA.

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## REPORT

ON THE WATERS OF NORTH CAROLINA, WITH REFERENCE TO THE  
CULTIVATION OF OYSTERS, TOGETHER WITH THE RESULTS OF  
THE SURVEY OF THE OYSTER BEDS.

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### THE AREA EXAMINED.

#### GENERAL DESCRIPTION.

The waters subject to the jurisdiction of the State of North Carolina consist mainly of twelve Sounds, extending and connected with each other along the coast from the Virginia line, in Lat.  $36^{\circ} 33' N.$  to the Cape Fear River, in Lat.  $34^{\circ} 53' N.$  In the order in which they occur from north to south they are Currituck, Albemarle, Croatan, Roanoke, Pamlico, Core, Bogue, Stump, Topsail, Middle, Masonboro and Myrtle Sounds. Between Bogue and Stump Sounds are four estuaries, known as Bogue, Bear, Brown and New Inlets. Between Core and Bogue Sounds is another estuary, forming the harbor of Beaufort, and the Cape Fear River expands at its mouth so as to form another. The difference in latitude, over two and one-half degrees, between the most northerly and southerly of these sounds indicates considerable climatic difference; but the area upon which oysters can live is considerably within the northern extreme, and the climate, consequently, so far as it affects molluscan life, may be considered uniform. Currituck and Albemarle Sounds are excluded from consideration, as they are practically of fresh water. Albemarle Sound, however, receiving as it does the waters of several large rivers and containing within its own limits 5,631,400,000 tons of fresh water, whose only outlet is Pamlico Sound, exercises an important influence upon all forms of life in the latter body; and occasions will arise in the future as in the past, when that influence will be so great as to be destructive to the organisms existing about the head of the Sound.

*Croatan Sound*, through which most of Albemarle's waters find their way, is about eight miles long and from two to four miles broad, with a general depth of water of from eight to ten feet. Only small creeks, draining the adjacent lands, empty into it; but the influence of Albemarle Sound is usually too great to permit the existence of oysters except about the lower, southern limit, near the Roanoke Marshes light house.

*Roanoke Sound*, separated from Croatan by Roanoke Island, is a narrow body of water, eight miles long and from one-half mile to two miles wide. The greater part of this area is a shoal with but from one to three feet of water on it; but a narrow channel extends along the Roanoke Island shore with a greater depth of water. The shallowness of the Sound prevents the flow of a very large amount of fresh water from Albemarle Sound, and the proximity of Oregon Inlet to the southern limit causes a sufficient amount of sea water to enter to overcome any tendency towards low specific gravity. Hence, oysters extend throughout the Sound wherever the water is sufficiently deep to protect them from the extremes of heat and cold they are likely to encounter in this region. The area of Roanoke Sound is 21,608 acres; of Croatan Sound, 26,751 acres.

*Pamlico Sound* lies south of Croatan and Roanoke Sounds, and is an enormous sheet of land-locked water, comprising, with its tributaries, an area of 1,149,464 acres. It is bounded on the east and protected from the sea by a narrow strip of sand beach called the "Banks," while on the west it washes the shores of the counties of Dare, Hyde and Pamlico. It extends in a north-easterly and south-westerly direction sixty miles, and is from fifteen to twenty miles wide. Numerous creeks and two large rivers, the Pamlico and Neuse, together with Albemarle Sound, pour fresh water over this area, while Oregon, New, Hatteras and Ocracoke Inlets and Core Sound admit the salt, oceanic waters. The depth of water varies considerably, the least lying, naturally, along the shores. Several long shoals, notably the Brant Island and Bluff Point shoals; over which but seven and ten feet of water are found, make out nearly across the Sound; but the



general depth is from fifteen to twenty feet, and in a few places twenty-six feet. In the deep water, the bottom is soft; but in the neighborhood of the shoals and shores it becomes harder, consisting of sticky mud or sand. There are no rocks, other than "oyster rocks," in this or any of the other Sounds.

The inlets, or openings in the "Banks," through which connection is made with the sea, are excellently spaced along the eastern boundary of the Sound. At the head, where the influence of Albemarle Sound is greatest, two openings, Oregon and New Inlets, occur within eight miles of each other. While these openings are both small, yet a sufficient amount of sea water is admitted to temper the extreme freshness that would otherwise prevent the growth of shell fish. Occasionally, in the extreme northern part of the Sound, after heavy freshets, the water will become too fresh and oysters will either perish or be greatly impaired in quality; but this occurs rarely, and under the normal circumstances the inlets afford quite a sufficient supply of salt water.

From New Inlet the coast is unbroken for about thirty-five miles; but opposite this stretch there is no considerable influx of fresh water, and the absence of an inlet does not disadvantageously affect the oysters growing in the locality. In the southern part of the Sound, where the influence of the large rivers and creeks is greatest, two large openings, known as Ocracoke and Hatteras Inlets, occur within fifteen miles of each other. In addition there is more or less salt or brackish water flowing in from Core Sound.

The average density of the water is 1.0115, which, however, varies greatly with the locality, weather and season of the year. The currents, except in the neighborhood of the inlets, and at the head of the Sound, are sluggish and influenced greatly by the wind. The general set is to the northward and eastward or southward and westward, with the wind, and with a velocity of from one-quarter to one-half mile per hour.

*Core Sound* extends from the southeastern extremity of Pamlico Sound to the harbor of Beaufort. It is a long, narrow and shallow sheet of water, thirty-one miles long and about

two and a half miles broad. Its area, including its several tributaries, is 83,472 acres. While the water is generally shoal, the depth varies from one to ten feet in different parts of the Sound; the average depth is about three to four feet, and not more than five feet can be relied upon for purposes of navigation. The shoalest water lies along the eastern or "Banks" shore. Numerous estuaries make out of this Sound to the westward, all of which, as does the Sound itself, receive considerable quantities of fresh water. Brackish water also enters the Sound at its junction with Pamlico. The salt water is derived from the flow into Beaufort harbor, that inlet being connected with, and properly a part of, Core Sound. The strength and direction of the currents are mainly influenced by the force and direction of the prevailing winds, which are from the southward and westward and northward and eastward. A southerly wind will lower the water and a northerly and easterly wind raise it; but while the height of the water and velocity of the current is greatly influenced, the density of the water remains practically the same. The average current is about one-half knot per hour, setting to the northward or southward with the wind. The average density is 1.0176. The bottom is generally sandy and firm, and covered more or less with grass and sponges, the former predominating. In the deeper water, both in the Sound and tributaries, muddy bottoms are found; but this area is inconsiderable. The climate is mild and ice seldom forms over the entire body of water. The heat of the summer months is great, however, and has rather too stimulating an effect upon molluscan life. The Sound is too shallow and too well protected for the gales to have any serious influence upon shell-fish, except on the shallow bank along the eastern border.

*Bogue Sound* is a sheet of water separated from Core Sound only by the inlet which forms the harbor of Beaufort. It is similar in its general aspects to Core Sound except in the depth of water, which is less. The Sound extends in an easterly and westerly direction and is about twenty miles long by two miles wide, containing with its tributaries an area of 21,997 acres.



The depth of water varies from one and two feet to five and six, but is generally not over two and a-half feet, except along the northern shore. Several small, fresh water streams empty into the Sound, but the principal supply of fresh water is derived from the drainage of the adjacent lands. Salt water is admitted from Beaufort harbor at the eastern end and Bogue Inlet at the western end. The currents are tidal and sluggish, but are influenced considerably by the force and direction of the wind. The average density of the water is 1.0203. The bottom is sandy with a light covering of mud, and large quantities of grass and sponge grow over it, except in the deep spots. The climate is mild, but very warm in summer, and the shelter afforded by the high wooded banks and shores prevents the strong southwesterly winds which prevail, from effecting anything of consequence.

Beyond Bogue Sound, the survey has not yet progressed sufficiently to justify more than a general description of the remaining area.

The coast from Bogue Inlet to the southward is low and fringed by the narrow, shallow sounds already enumerated. All these Sounds produce oysters; but the principal part of the stock consists of the so-called raccoon oyster, which is not marketable unless cultivated by transplanting.

Portions of the White Oak River have been surveyed and New River is now being examined. The latter estuary, a beautiful sheet of water, contains some of the finest oyster ground in the world. Its inaccessibility will, however, prevent its utilization some time. The other Sounds have more or less ground suitable for the growth and cultivation of oysters, and the whole region will, circumstances permitting, be made the subject of a supplementary report.

#### GENERAL PLAN OF WORK.

The resolution of the General Assembly requiring the Board of Agriculture to conduct the examination also specified distinctly the ends to be attained: The natural oyster beds and private oyster gardens were to be surveyed and located, and a gen-

eral examination of the waters of the State was to be made. In developing a general scheme of work it was necessary, therefore, to keep in view those desired ends; their accomplishment being imperative, whatever else might be done. An intelligent appreciation of the purposes of the Legislature was afforded, however, through the preamble of the resolution, which stated that it was a furtherance of the oyster interest, that is, its expansion, which was desired and to which the examination was expected to conduce.

In addition, then, to the direct requirements of the resolution, an adjunctory line of work was indicated, which was none the less important and which may be defined as a diffusion of knowledge of the principles and methods of successful oyster-culture. To secure economical and harmonious progress in each of these several branches of work, it was deemed necessary to make them, as far as possible, coincident and in a measure correlative; and as so much depended upon the coöperation of the citizens of the seaboard counties, it was wise to sacrifice some time and labor to the explanation of the purposes of the examination and the beneficial results it would bring about. The area to be examined was not only large, but was difficult of access. The means at the disposal of the State for transporting and subsisting those engaged upon the examination were necessarily limited; the investigation, therefore, would have been made thorough only by the expenditure of considerable sums and at the cost of much personal discomfort, had not the valuable coöperation of the U. S. Coast and Geodetic Survey been secured. Even with that assistance, the peculiar character of many of the areas to be studied made the work one of considerable difficulty.

The preliminary reconnoissance of the field, made upon the inception of the examination, indicated the advisability of dividing the entire area with reference to the particular character of investigation desired for each portion. For instance, Bogue Sound naturally would be a separate study, having characteristics peculiar to itself. There was also reason to suppose that the northern and southern portions of Core Sound would present differences in the



principal features to be studied. Again, Pamlico Sound should naturally be distinguished from its tributaries, and different portions of Pamlico Sound would not only require different treatment, but on account of hydrographic and physical characteristics, would necessitate different methods of work.

As the examination progressed, and it became evident that detailed surveys of the whole area could not be completed before the meeting of the Legislature, the desirability of sub-dividing the area so as to permit practical utilization of the information obtained, also became evident. For the foregoing reasons, the tidal waters of the State have been divided into twenty-nine sections of various areas, which will be subsequently described in detail.

Field work was begun December 1st, 1885, and its direction and progress were arranged so as to permit as little interference by the weather as possible.

The proposed plan of work was to extend the examination from Morehead City to the southward, accomplishing as much as possible by the spring. To then extend operations from Morehead to the northward through Core, Pamlico, Albemarle and Currituck Sounds. The time remaining (less than a year) was so short that it would be hardly possible to make the examination as exhaustive as was desirable. But should the work be delayed by unforeseen accidents, it would only be necessary to pass over a few areas of no great general importance, leaving them for future study and examination.

The results of the work in the several sections will be presented in detail under each section.

In carrying out the first special requirement of the resolution, a difficulty, experienced in all oyster localities, was at once encountered. The question arose here, as elsewhere, as to what was properly a "natural oyster bed." Naturally that question had to be answered before the natural beds could be surveyed and located. Very few people know what is, or what constitutes a "natural bed." Indeed, it is only a matter of opinion, at the best, and opinions are likely to be influenced largely by self-interest. A large number of persons make a distinction between

oyster beds that ebb dry and those that are covered at all states of the tide—a distinction which, it is needless to say, does not have any sound foundation to rest upon. Many also appear to think that a natural bed is not a “natural bed” in the meaning of the law, because it is a little one. On the other hand, there are some whose definition of natural bed is so liberal that it not only covers all places where oysters were in the past or are in the present, but includes any area where they might, could, would, or should grow in the future. Arguments have been made to the effect, that as the drifting spat was evidently a product of nature, wherever the spat attached or oysters grew, that spot became a natural oyster bed. Evidently such a view would preclude any and every system of oyster culture. On the other hand, it has been argued that small groups and bunches of oysters, separated and distinct from any considerable area, were not natural beds within the meaning of the law. A legal decision (by Judge Goldsborough of Maryland) defines a natural bed as one not made by man, and of sufficient area to have been profitably worked by the general public, as common property, within some recent period of time. This decision has been practically adopted by the Shell-fish Commission of Connecticut in defining the natural beds of that State, and their course has been approved by legislative enactment. Useful as a guide, however, it would not be proper to be strictly governed by the Goldsborough decision in defining the natural beds of North Carolina.

In this State the oyster industry is yet in its infancy. The population is too sparse and the present demand too slight to have caused any continuous fishery or even any general knowledge of the positions or areas of the natural beds. Mere testimony as to previous fishery or non-fishery would not therefore, in all places, be conclusive; and it was necessary to supplement such testimony by actual examination of all the adjacent area. Such has been the course adopted. Interrogation of the oystermen and fishermen has indicated the approximate positions of the oyster-beds. The locality was then searched carefully, the boundaries of the bed or beds defined, and allowance made for



the possible expansion of the area in the future. Right lines will inclose the whole, which is considered, and will be designated, as "public ground" in this report. This method has several important and practical advantages over any other that might be adopted. Should the so-called "public grounds" be the subject of legislative action, they can be specially described and enumerated in specific instead of general terms. They can be made a public, common property, without fear of infringing upon any rights or privileges, for within their boundaries are included not only the present natural beds, but enough adjacent area to allow for all natural expansion for all time to come; and the boundaries laid down, being considerably outside the natural beds, there will be no need for future surveys to determine the amount of that expansion. Finally, the method adopted, in addition to the other advantages, permitted the prosecution of the work with greater economy of time, labor and money.

The survey of the private ground, so-called oyster gardens, was comparatively a simple matter. The law permits the Clerk of the Superior Court of the County to grant a license to any inhabitant of the State, and the general practice is to require a survey by a competent surveyor to accompany the application. The metes and bounds of the garden are consequently, in most cases, already of record, and it is only necessary to locate the initial point of each garden with reference to some of the general triangulation points, to enable the private grounds to be accurately plotted on the general map. The clerks of the Courts furnished certified copies of all surveys and applications, and where the application stated that no natural oyster-bed is included, and was in the form of a deposition, only the location of the initial point of the boundaries was attempted. If there was any reason to suppose that the specified boundaries included a natural oyster-bed, a careful examination of the garden was made for the purpose of determining the fact.

The general examination of the waters of the State with reference to their possibilities for oyster culture was the most difficult and delicate part of the work. It required a scrutiny of the

water and bottom ; measurement of the currents, determination of the specific gravities at various states of the tide and seasons of the year ; microscopic examinations of water, bottom, and oysters ; a study of all the various surveys that have been made from time to time, and a more or less particular examination of the fauna of each locality. Some of this work could be done in the field. Much was necessarily office work, and fortunately the publications of the Coast Survey and U. S. Fish Commission supply a good deal of valuable data and have saved considerable time and expense.

In order to carry out the spirit as well as the letter of the resolution and make the examination of as early practical benefit as possible, included in the general scheme was a project for diffusing knowledge as to the possibilities of the industry in this State and the best manner of utilizing them. So many of those most directly interested in the extension of the industry are of the poorer class, without educational advantages, that publications alone would either fail of attention or fail to reach them at all. Consequently it was deemed best to put such advice and information as could be given, in the shape of familiar and informal lectures, directed especially to those who were to be most benefited by a knowledge of the experiences of other oyster-growing localities. A number of such lectures have been given with most gratifying success, both as to the interest of the audience and as to the effect in a practical way ; quite a number of additional oyster gardens having been taken up in the several counties since the middle of November, 1885.

#### METHODS USED IN THE SURVEY.

The area and position of each natural and artificial bed were determined by utilizing the methods in use in ordinary hydrographic surveys.

Large scale maps constructed by the Coast Survey in such a manner as to eliminate so far as possible errors, due to expansion and contraction of the paper, have been supplied. Upon these maps is indicated the exact position of several points determined

by the Coast Survey triangulation. These points are also located by marks in the ground, and except where there has been a great lapse of time since the original survey, the positions can be ascertained and re-occupied. Errors which would arise from measuring new bases have thus been avoided. The old triangulation points having been found and signals erected thereon, such additional signals as were needed were put up and located by triangulating from the original triangulation points of the Coast Survey as a base. In only a few cases has it been necessary to carry this secondary system of triangles to any great distance, and consequently nearly all positions are in direct connection with the Coast Survey system, and the location of all lots and beds is with reference to geodetic points, which can always be recovered and re-occupied. This is a matter of great importance, especially should any conflict or difference arise as to titles.

The necessary signals having been established, the ground in the locality has been gone over by an observer in a boat, who felt the bottom with a pole, and recorded his observations for reference. As often as necessary, his position was fixed by measuring with a sextant the angles between several of the signals. Usually, it has been the custom to get the local oystermen and fishermen to indicate the approximate position of the beds, before searching for them. The area in this immediate vicinity was then subjected to careful examination, in order to determine the boundaries of the bed. In addition, wherever there was reason to suppose undiscovered beds might exist, all other ground was examined with the same care. Whenever the depth of water has permitted, the schooner has also been sailed over the ground, dragging a large chain, a method which invariably detects not only the presence of oysters or shells on the surface, but also those that may be buried several inches in sand or mud. No pains have been spared to ascertain the position and locate every natural bed; and that term includes every area which has been commonly worked by the public, or which produces oysters, marketable or otherwise, without the assistance of man.



The artificial beds, or private grounds—so-called oyster gardens—which have been established under authority of section 3390 of The Code, have been located as described. The Clerks of the Superior Court in each county have supplied certified copies of the surveys, or designation, where there are no surveys; the owners of the lots have been notified whenever the officers reached their locality, and requested to point out the beginning stakes of their several tracts. When the owners declined or neglected to attend, the beginning stake has been ascertained by inquiry. These stakes have been located by measuring sextant angles between the signals already established, and the initial point having thus been determined, the metes and bounds as given in the license or survey on file have been laid off, and the area of the lot ascertained. If the practice of requiring surveys and descriptions, giving metes and bounds, was uniform throughout the State, much trouble and labor would have been saved. But instead of being uniform, it has been just the reverse; each Clerk of Court having a different method of procedure, and a different form of application and license. Again, as these lots are usually described as beginning “at a stake,” or “in a creek,” or “off a point,” it was absolutely necessary to secure the presence of the owner before the lot could be located. Generally, the owners have very willingly pointed out beginning stakes; but unless they choose to do so, there is absolutely no way of locating the ground in the vast majority of cases.

The general examination of the waters of the State, with reference to their possibilities for oyster culture, required principally the study of two characteristics, viz.: of the water and of the bottom.

Oysters will and do live on bottoms of almost directly opposite character. They are found on sand shoals and in soft mud; on rocks, stumps and trees, and in clay and along the borders of marshes. In the same way they exist in water that is almost fresh, and in other cases where it is almost salt. The study of other localities, has given, however, a standard for comparison; and it may be accepted that the bottom should be as nearly as

possible of sand or other substance sufficiently hard to support the oyster, covered by a light layer of sticky mud. The principal necessity is that the oyster should not be smothered either by sinking into the bottom or by the shifting of the sand or other superficial stratum. In addition to the character of the bottom itself, it must be ascertained whether there is on it too great an amount of animal and vegetable life to permit the introduction of new forms. In other words, some study of the fauna and flora of the bottom must be made. Generally speaking, antagonistic forms of life can be eradicated just as weeds, worms or bugs can be removed from a tract of upland; but in some cases the practical difficulty of doing so is so great as to render the locality unsuitable for experiment. The scrutiny of the bottom had, therefore, the ascertainment of the foregoing particulars as an end. To accomplish it the ground has been felt over with a pole, which method has been supplemented by dragging the chain whenever such a course has been practicable. By the use of oyster tongs, specimens of the bottom, of oysters and of the various other forms of life, have been obtained. Frequently the water has been sufficiently shallow to permit an ocular inspection of the bottom, and in addition to these actual, personal examinations, a good deal of information has been gathered from fishermen and others living in the locality. Only a small proportion of the actual number of examinations of bottom have been recorded—probably not one-fifth—but these exceed 100,000 in number.

The character of the water has an important, if not the most important, influence upon the life of the oyster. Chemical analyses are desirable, and in some cases necessary; but generally speaking, the determination of the specific gravity of the water provides a sufficiently accurate standard for forming either comparisons or opinions.

The investigations of the Coast Survey in Tangier and Pocomoke Sounds, tributaries of Chesapeake Bay, and probably the largest oyster ground in the world, have indicated 1.0140 as the standard specific gravity, 1.0000 indicating the density of dis-

tilled water at 60° F. The investigation also showed that the specific gravity of those waters could fall considerably below the standard without serious effect, and Count Pourtales, who investigated the subject many years ago, came to the conclusion that oysters would live in water of as low specific gravity as 1.0010 which is .013 below the standard here accepted. Indeed, within reasonable limits, it is not so much the absolute specific gravity as it is the rate and range of the fluctuations, which must be considered; for oysters can be accustomed to water of very great or little density; but water that changes rapidly from a high to low specific gravity or the reverse, will soon destroy the animals.

In determining the specific gravity of the water, hydrometers of a very delicate character, devised for this purpose by Prof. Hilgard, late Superintendent of the U. S. Coast and Geodetic Survey, have been used. Three are necessary to cover the ordinary variation between sea and fresh water. They are described in the Report of the Coast Survey for 1874, Appendix 16.

Specimens of water, aggregating 931 in number, have been secured from every locality, and several special lines across the Sounds have been run, for the purpose of obtaining what would be, practically, simultaneous observations at a number of points. All readings of the hydrometer have been reduced to the standard temperature of 60° F.

It is well known among practical oystermen that oysters thrive best in rapid currents, though the reasons for their so doing are somewhat obscure. Probably the current brings a larger quantity of food within the reach of the animals, and also preserves them from being overwhelmed by deposits of sediment.

Whatever the cause, the fact is well known, and any study of an oyster ground would be incomplete without more or less investigation of the direction and velocity of the currents. Only a rough approximation, however, is necessary, and though the Coast Survey investigations in the Chesapeake have shown that over the best beds the current was from one quarter to one-half knot per hour, yet no fixed velocity can be assigned as most



advantageous. Generally speaking, the swifter the current the better; but an entire absence of current does not preclude the successful growth of oysters.

The currents in the Sounds have been measured by using an ordinary chip log and line. At every anchorage these measurements have been made at intervals of four hours. Measurements have also been obtained by the boat parties, when separated from the schooner, and sufficient data have been accumulated to give a fair idea of the general set and strength of the currents in those parts of the Sounds which have been surveyed.

An oyster bed is a very closely settled community; not only oysters, but innumerable other animals live on the area and its products. Many of these are directly harmful to the oysters; many others are only indirectly so. Among the former are nearly all the carnivorous gasteropods, or sea snails, and many species of crabs and star-fishes. Indirectly harmful, by devouring or obstructing the passage of food that would otherwise reach the oyster, are nearly all the large bivalve mollusks, such as clams, mussels, etc., many gasteropods and crustaceans, the sponges, grass and weeds. In a community of this sort evidently the struggle for existence must be severe, and it has been noticed that as one class of animals decreased there has been a tendency to increase upon the part of all the others. These characteristics are not peculiar to oyster beds alone; all sea bottoms present similar features to a greater or less extent, and all have to be studied with reference to those features before a correct estimate can be given of the possibilities of any area.

The examination of the bottom, water, and measurement of currents has, therefore, been supplemented by investigating, when practicable, the amount and character of the life on the beds and surrounding bottoms; and while this part of the work, for lack of time, has necessarily been superficial, yet enough information has been obtained to answer the purposes of the survey.

Changes of bottom have a very serious effect upon natural or planted oysters, but it is only necessary to determine whether such changes are going on or are likely to occur. In the absence

of direct experiment, the only method of forming an opinion on this point is by studying the maps and archives of the Coast Survey and comparing the results with more recent determinations. So far as possible this has been done and in addition, much valuable information as to the Sounds has been secured from the same source.

From the data obtained as has been described, the work has been plotted and certain conclusions reached. The latter are not to be considered as of absolute accuracy—that cannot be arrived at without elaborate and expensive experiments; and though the several locations, either of natural or artificial beds, are as exact as the most approved methods of surveying can make them, the decisions as to the suitability of the various areas for oyster culture are but opinions, based upon a careful study of all the conditions necessary to the life of the animal. That others may, so far as possible, be enabled to decide for themselves, the results of our observations in each section and locality, as well as the conclusions based upon them are given in the following pages :

#### DESCRIPTION OF SECTIONS.

For the reasons already specified, the waters of the State have been divided into 29 Sections. The metes and bounds, together with the area of each section are given, and also as minute a description as possible of the ground. The exact positions and areas of the natural and artificial beds cannot at present be stated, the field work not yet being plotted on the large scale maps.

#### SECTION I.

*Description:* Begins at the U. S. C. S. triangulation point, known as "Caroon's Point," in Lat.  $35^{\circ} 57' 24''.59$  N., and Long.  $75^{\circ} 48' 22''.94$  W., thence runs N.  $83^{\circ} 41'$  E. (true)  $7\frac{3}{4}$  miles, more or less, to the U. S. C. S. triangulation point, known as "Mann's Point," in Lat.  $35^{\circ} 58' 14''.7$  N., and Long.  $75^{\circ} 40' 05''.2$  W., thence along the western shore line of Bodie's Island

to a point at the intersection of that shore line with a line drawn from the U. S. C. S. triangulation point known as "South Base," in Lat.  $35^{\circ} 48' 35''.01$  N., and Long.  $75^{\circ} 32' 59''$  W., to the U. S. C. S. triangulation point known as "South Duck Island," in Lat.  $35^{\circ} 47' 40''.95$  N., and Long.  $75^{\circ} 35' 20''.30$  W., thence along said line S.  $64^{\circ} 47'$  W. (true)  $2\frac{1}{8}$  miles, more or less, to said U. S. C. S. triangulation point, "South Duck Island," thence N.  $79^{\circ} 45'$  W. (true)  $6\frac{1}{2}$  miles, more or less, to Roanoke Marshes Light House, in Lat.  $35^{\circ} 48' 40''.7$  N., and Long.  $75^{\circ} 42' 03''.73$  W., thence West (true) to a point where the said West line intersects the shore of the mainland; thence with said shore line of mainland to the beginning, containing, more or less, 48389.4 acres.

This section includes Croatan and Roanoke Sounds, and has only been superficially examined. It is intended, on account of the inclemency of the winter months, to defer the detailed examination of the section until the Spring.

*Croatan Sound* is 10 miles long and about  $3\frac{1}{2}$  miles wide, and extends in a N. N. W. and S. S. E. direction. Numerous small creeks empty into it from the mainland and from Roanoke Island and it is also the outlet of Albemarle and Currituck Sounds, which bodies are practically of fresh water.

*Depth of water:* The average depth is from 8 to 10 feet. Along the western shores, from Roberts' Fishery to Callaghan's Creek, sand shoals make out for one-quarter to one-third of a mile, and to the southward and eastward of Fleetwood Point, these shoals extend fully a mile in a S. E. direction. Along the eastern shore the water is bold, except about Weir's Point, where a sand shoal makes to the southward and westward. Two comparatively deep slues, of over fifteen feet, make up on each side of the Roanoke Marshes Light House for about two miles, and at the head of the Sound there is another area four to five miles long and about a quarter of a mile wide, which has a depth of from 13 to 18 feet. A sand shoal, nearly bare at low water, surrounds Fulker's Island in the eastern section of the Sound.

*Character of bottom:* This is generally of sand, covered with a light layer of mud, except on the shoals already noted, where



it is of sand alone, and in the deep slues, where it is of sticky mud. Many small mud spots will also be found in the Sound, but their extent is not great. The covering of mud is thicker in the channel ways than along the shores.

*Specific gravity:* The average specific gravity is 1.0074. The least observed was 1.0020, in April, about the head of the Sound; the greatest was 1.0141, in October, near the Roanoke Marshes Light House. The least density was during north-westerly winds and the greatest after a south-easterly gale.

*Oyster beds:* These have not yet been accurately located. They all lie, however, about the lower or southern end of the Sound, in the neighborhood of the Roanoke Marshes and the islands abreast of them. The oysters are small and the beds much broken up, partly through working them, but principally through natural causes. It appears as though there was a more or less constant deposit going on, due to sediment brought down from Albemarle Sound and from the wash of the adjacent shores. No predatory shell fish were found in this vicinity.

*Roanoke Sound,* lies between Roanoke Island and the sand beach known as Bodie's Island, which separates the Sound from the ocean. At the southern end of the latter island is Oregon Inlet, an opening about one-third of a mile wide in the beach and through which the oceanic water is admitted to Roanoke and the northern portion of Pamlico Sound. Roanoke Sound is about 14 miles long; but only about 11 miles of this length is included in the section. At its northern end, it expands to a width of about 4 miles; but on an average is not more than 2 miles wide. And about the middle of the Sound this width decreases to a little over one-half mile.

*Depth of water:* The principal part of the area is taken up by sand shoals with but 1 or 2 feet of water over them. In the northern part where the Sound expands in an easterly and westerly direction, the depth increases to 6 and 8 feet; in the southern portion, below Broad Creek, where there is another expansion, the depth is from 4 to 5 feet; and in the channel, which runs along the shore of Roanoke Island, from 5 to 12

feet may be found. In Shallowbag Bay, which lies between Dolby's and Ballast Points, near the north end of Roanoke Island, the water is from 3 to 7 feet deep; and in Broad Creek, which is near the southern end of the island, 3 to 5 feet.

*Character of bottom:* Generally of hard sand. In the northern portion it becomes soft, consisting of mud, and in the deep channel along Roanoke Island it is sticky, consisting of tenacious mud and sand. In Shallowbag Bay it is soft, and in Broad Creek hard, but with some mud.

*Specific gravity:* This ranges from 1.0070 to 1.0156, the least being found about the northern, and the greatest about the southern end of the Sound. The average density is 1.0104.

*Oyster Beds:* These lie along the edges of the channel from the southern end of Roanoke Island, nearly to Ballast Point. They have not yet been examined but have been reported as being very much broken up, which may well be the case, as the locality is the scene of a very active fishery. Such specimens of oysters as were obtained were of good quality and flavor, generally much superior to those coming from the adjacent Sound. No predatory shell-fish were seen or reported as being common.

There are a number of oyster-gardens in this section, whose approximate positions are indicated on the map accompanying this report. They will be more definitely located, and with the natural beds carefully examined when the elaborate investigation of this section is undertaken.

The currents in both Croatan and Roanoke Sounds are quite strong, being on an average one half knot per hour, and in certain localities and under certain circumstances much stronger. About the Roanoke Marshes and at the southern end of Roanoke Sound, near Duck Island, the ebb and flow is very strong, and with or after favoring winds exceeds at times a knot an hour. The usual set is to the northward and southward, and both direction and velocity are greatly influenced by the direction and force of the wind. There is, however, a general southerly set from Albemarle Sound, which is only interrupted by the backing up of the waters in Pamlico after strong easterly and southerly winds.

While it is possible that both Croatan and Roanoke Sounds may be largely utilized for the purpose of raising oysters, it is not, in my opinion, probable that such will ever be the case. It will be observed that while the depth of water and character of the bottom in Croatan Sound are in every way suitable, yet the specific gravity is rather low; and at times, no doubt, the water becomes almost entirely fresh. The appearance of those beds examined leads to a supposition that many of the oysters have been destroyed by the absorption of fresh water; and while this has been the case in many other localities, notably the James River, Va., yet the probabilities are that here it is of too frequent occurrence to justify the expenditure of much money in making experiments.

In Roanoke Sound the same cause will operate, though to a less extent; but here, also, a large portion of the bottom is unsuitable, consisting of sand shoals having but little or no water on them. Taking these facts into consideration, it is concluded that only that portion of Croatan Sound lying south of Fulker's Island and of Roanoke Sound, part of that lying south of Green Island, can be considered as suitable ground. Along the Roanoke Island shore of Roanoke Sound, especially in Broad Creek and the other tributaries to the southward, the conditions are all favorable. But in Croatan Sound I have felt considerable hesitancy in assigning even so large an area as that indicated on the chart, as available. Subsequent study of these localities may, however, modify these opinions. The area, with the above restrictions, in the section which is considered suitable amounts to 14,866 acres, of which 6,948 acres are in Croatan and 7,918 acres in Roanoke Sound.

## SECTION II.

*Description:* Begins at the U. S. C. S. triangulation point known as "Stumpy Point," in Lat.  $35^{\circ} 41' 29''.96$  N., and Long.  $75^{\circ} 42' 48''$  W., thence runs along the shore line of mainland to a point at the intersection of a line running West (true) from Roanoke Marshes Light House to the shore of mainland,



thence runs East (true) along said line to said Roanoke Marshes Light House in Lat.  $35^{\circ} 48' 40''.7$  N. and Long.  $75^{\circ} 42' 03''.73$  W., thence S.  $79^{\circ} 45'$  E. (true)  $6\frac{1}{2}$  miles, more or less, to the U. S. C. S. triangulation point known as "South Duck Island," in Lat.  $35^{\circ} 47' 40''.95$  N., and Long.  $75^{\circ} 35' 20''.30$  W., thence N.  $64^{\circ} 47'$  E. (true)  $2\frac{1}{8}$  miles, more or less, to a point at the intersection of the shore line with said line drawn from "South Duck Island" triangulation point, to the U. S. C. S. triangulation point, known as "South Base," in Lat.  $35^{\circ} 48' 35''.01$  N., and Long.  $75^{\circ} 32' 59''$  W., thence to the southward along the western shore of the "Banks" or Bodie's Island to a point at the intersection of the shore with a line drawn from the U. S. C. S. triangulation point, known as "Pea Island," in Lat.  $35^{\circ} 42' 37''.98$  N., and Long.  $75^{\circ} 30' 41''.06$  W., to the U. S. C. S. triangulation point known as "Stumpy Point," thence with said lines  $83^{\circ} 30'$  W. (true)  $11\frac{1}{4}$  miles, more or less, to said "Stumpy Point," the beginning, containing, more or less, 45757 acres.

This section is practically the extreme northern portion of Pamlico Sound. It has been very carefully and systematically examined, and a map on a large scale is in course of preparation.

*Depth of water:* This is uniform over the greater portion of the area being generally from 10 to 12 feet. Close along the western shores, sand shoals with but three feet of water will be found, and off the several points many stumps and rotting trees. The eastern portion of the section is very shoal, and east of a line drawn south from the end of Roanoke Island, not over 6 and 7 feet will be found, which depth decreases to the eastward to 2 and 3 feet or less, the shoal water extending fully  $3\frac{1}{2}$  miles from the "Banks" side of the section. Many narrow and tortuous slues, wherein there is a greater depth of water, intersect the shoals, especially in the neighborhood of Oregon Inlet; but the general depth is not above 4 feet. From the western edge of this plateau the water deepens gradually for about a mile and a half, at which distance the deep water of the channel is reached. About the southern, central portion of the section the

depth increases to 15 and 17 feet, and this slue, if it can be called so, as it is two miles wide on the southern boundary of the section, extends to the northward three and a half miles, where it comes to a head, the depth gradually diminishing to 12 and 13 feet. Over the oyster beds there is usually less water by a foot than over the contiguous bottoms.

*Character of bottom:* This is either soft or hard mud, or soft or hard sand, except where shells or oysters are found. On the shoal plateau in the eastern portion, the bottom is hard sand, softening as the water deepens. Close along the western shores hard sand is also found, which becomes soft as the depth increases. In the channel way and on the major portion of the section, a moderately soft or sticky bottom exists, interspersed with numerous large areas of hard sand, with a light covering of mud. About Bunton's Islands and near Hog Island, along the northern boundary of the section, are several sand shoals, and the bottom generally in that neighborhood is of sand. As a rule, the bottom is soft or sticky, consisting of mud or mud and sand in the deep water; and elsewhere of sand, which grows harder as the shores or shoals are approached. Only in a few spots of inconsiderable area, is the bottom so soft as to preclude oyster culture. But along the edge of the elevated plateau or sand shoal in the eastern portion, and on that shoal, the bottom possibly shifts during the gales. The area of soft, muddy bottoms in the section is 5,700 acres; of hard sand, whereon there is less than 4 feet of water, 13,900 acres.

*Specific gravity:* The average density in the section is 1.0105. The least density was 1.0020, observed in April, just south of the Roanoke Marshes Light House during northerly winds. The greatest density, 1.0141, was found in October, off Oregon Inlet during easterly winds. The density of the water increases always with easterly and southerly winds, and decreases when the wind is from the northward or westward. The increase is due to the backing up of the water in Pamlico Sound and to the influence of Oregon Inlet, though the latter is usually slight and absorbed to a great extent by Roanoke Sound. The fall in specific gravity dur-

ing the northerly and westerly winds is due to the flow of water from Albemarle Sound; and without doubt, there are occasions during the freshets in that body, when the water in this section becomes too fresh; but this condition does not appear to continue for a sufficient length of time to destroy the oysters in great numbers, as is shown by the large number of beds now existing.

The density of the water may be considered uniform for the whole section, with a slight increase in the eastern and southern portions.

*Oyster beds:* The size and position of these can be best understood by referring to the map, where they have been laid down from actual locations. It will be seen that they are quite numerous, and generally occupy positions along the edge of the deep water slue previously described. Many of these beds are only small lumps of oysters and shells, and many are also more or less covered with layers of sand or mud. It is noticeable, however, that the number and size of the beds increases as the lower limit of the section is approached, and it was observed also that a much smaller number of beds appeared to be covered with mud or sand in that region than farther to the northward.

The oysters are small and of rather inferior quality; no enemies were found, and the beds are seldom worked, being in water too deep for the ordinary tongs. There are no artificial beds in the section.

*Currents:* These are of about the same strength as in Croatan Sound, varying from one-quarter to one-half knot per hour, frequently exceeding that limit, and quite as frequently disappearing altogether. Generally the set is to the southward, except when the wind is from that direction. Both the direction and velocity of the current are directly dependent upon the winds, and no regular tidal action has ever been observed.

The indications for this section are on the whole favorable with the exception of that portion of the area lying in the eastern part, and embracing the high sand shoal already described. Otherwise, the bottom is suitable, the currents sufficiently strong and though the water is of rather a low specific gravity, still it



is not so low as to make oyster culture impossible. Another deleterious influence is the deposit which is going on, as is evident from the number of beds which are covered with a light layer of mud or other sediment. While this influence is injurious, it would probably be less so if the areas were worked, as would be the case with an artificial bed. More trouble from this cause and from freshets will be experienced in the northern than in the southern portions of the section. The inferiority of the oysters is due principally to the fact that they grow on uncultivated ground, in crowded communities. With greater room for development they would improve in size and quality if not in flavor. The shoal ground in the eastern half of the section is unsuitable for oyster growing, principally on account of the shifting nature of the bottom and the want of the depth of water. It would grow clams excellently; but oysters would soon perish.

Of the total area, I consider 31,800 acres as suitable ground, of which 5,700 acres is a possible rather than a probable field for oyster cultivation. Of the remaining 26,100 acres, 970 being already occupied by natural beds, I have no doubt that a fair marketable oyster can be raised.

### SECTION III.

*Description:* Begins at the U. S. C. S. triangulation point known as "Gull Island," in Lat.  $35^{\circ} 28' 37''.82$  N., and Long.  $75^{\circ} 31' 29''.17$  W., thence runs N.  $13^{\circ} 10'$  W., (true)  $16\frac{1}{4}$  miles, more or less, to a point at the intersection of said line N.  $13^{\circ} 10'$  W., (true) with a line drawn from the U. S. C. S. triangulation point known as "Pea Island," in Lat.  $35^{\circ} 42' 37''.98$  N., and Long.  $75^{\circ} 30' 41''.06$  W., to the U. S. C. S. triangulation point known as "Stumpy Point," in Lat.  $35^{\circ} 41' 29''.96$  N., and Long.  $75^{\circ} 42' 48''.03$  W., the said point of intersection being the corner of Section IV., thence with said line from "Stumpy Point" to "Pea Island," N.  $83^{\circ} 30'$  E., (true)  $4\frac{1}{2}$  miles, more or less, to its intersection with the shore, thence along the western shore of Bodie's and Chickamiconico Islands to a point at the intersection of the shore line with the prolongation of a line drawn from the

U. S. C. S. triangulation point known as "Long Shoal Point," in Lat.  $35^{\circ} 34' 34''.53$  N., and Long.  $75^{\circ} 46' 54''.59$  W., to the triangulation point known as "Gull Island," thence with said line N.  $64^{\circ} 45'$  W., (true)  $2\frac{1}{4}$  miles, more or less, to beginning, containing, more or less, 45,157 acres.

This section is an unimportant one, consisting principally of the large shoal lying along the western shore of the "Banks" from Pea Island to Gull Island. It has only been superficially examined.

*Depth of water:* Along the western edge of the section from 6 to 10 feet may be found, but the principal portion of the area is occupied by a shoal having from 1 to 5 feet over it and being in many places bare at low water. This shoal, extending from 2 to  $4\frac{1}{2}$  miles from the Banks is intersected, especially in the neighborhood of New Inlet, by numerous tortuous slues and narrow channels, having from 5 to 12 feet of water in them. Through these channels the current runs with great velocity, cutting away the shoal in one place and building it up in another, so that a continual change of channel and depth is going on. Along the western border of the section, where the depth is more uniform, these changes do not take place.

*Character of bottom:* This is of hard sand except in the slues and channels on the shoals, where it is soft, and either of shifting sand or mud. A few spots of inconsiderable area (about, 200 acres in all), in the deep water, have a muddy bottom; but generally that portion, like the shoals, is of hard sand. The area of sand shoal with less than 4 feet of water, is 19,700 acres.

*Specific gravity:* For the section this is 1.0134. Only a few observations were taken in this neighborhood on account of the evident unsuitability for oyster culture of the greater part of the section. The density given is probably uniform throughout the area, increasing somewhat as New Inlet is approached.

There are no oyster beds, natural nor artificial, in this section. The currents over the greater portion vary in strength and direction with the winds and channels. In the neighborhood of New Inlet the general set is to and from that opening, the velocity

depending upon the character of the channel and depth of water on the shoals, as well as upon the wind. Along the western border the current sets sluggishly to the northward and westward and southward and eastward.

By far the greater portion of this section is unfit for oyster culture on account of the shoalness of the water and shifting nature of the bottom. Along the western boundary in from 7 to 12 feet of water, there is a strip of bottom on which oysters could probably be raised; but inexpensive experiments should be made before any extensive work is undertaken, as there is a possibility that the bottom will shift during heavy gales. This possible area amounts to 9,200 acres.

#### SECTION IV.

*Description:* Begins at the U. S. C. S. triangulation point, known as "Gull Island," in Lat.  $35^{\circ} 28' 37''.82$  N., and Long.  $75^{\circ} 31' 29''.17$  W., thence runs N.  $64^{\circ} 45'$  W. (true)  $16\frac{1}{8}$  miles, more or less, to the U. S. C. S. triangulation point, known as "Long Shoal Point," in Lat.  $35^{\circ} 34' 34''.53$  N., and Long.  $75^{\circ} 46' 54''.59$  W.; thence with the shore line of the mainland to the U. S. C. S. triangulation point known as "Stumpy Point," in Lat.  $35^{\circ} 41' 29''.96$  N. and Long.  $75^{\circ} 42' 48''.03$  W., thence running N.  $83^{\circ} 30'$  E. (true)  $6\frac{1}{8}$  miles, more or less, along a line drawn to the U. S. C. S. triangulation point known as "Pea Island," in Lat.  $35^{\circ} 42' 37''.98$  N., and Long.  $75^{\circ} 30' 41''.06$  W. to a point at the intersection of said line from the said "Stumpy Point" and the line drawn from the "Gull Island" triangulation point in the direction N.  $13^{\circ} 10'$  W. (true); the said point of intersection being the corner of section III, thence along said line, S.  $13^{\circ} 10'$  E. (true)  $16\frac{1}{4}$  miles, more or less, to the beginning, containing, more or less, 82,904 acres.

This is not only a very large, but a very important section. It comprises, besides an extensive area in the Sound itself, those important bays known as Parched Corn Bay, containing 917 acres, and Stumpy Point Bay or Lake, containing 1,389 acres.



*Depth of water:* Over the greater part of the section 14 feet will be found. In the northeast corner there is a tract about 4 miles long and 1 mile wide, which has only from 8 to 10 feet over it; the triangular shoal, known as Long Shoal, which extends from Sandy Point and Long Shoal Point as a base, in a southeasterly direction, 2 miles beyond the Long Shoal Light House, has from 7 to 11 feet on it; and off the mouth of Stumpy Point Bay, extends for  $1\frac{1}{2}$  miles a shoal with from 8 to 11 feet of water. In the southeastern corner is a small tract near Gull Island with an average depth of about 3 feet. Parched Corn Bay has from 2 to 6 feet, and Stumpy Point Bay, or Lake, has from 1 to 5 feet. Sandy Bay is shoal, having less than 3 feet.

*Character of bottom:* Generally this is moderately hard, in many instances consisting of a layer of sand two or three inches thick over softer and more tenacious bottom. In the southwestern part between Long Shoal and the center of the section, is a large area, on which there is a good deal of soft and sticky bottom, consisting of mud, or mud and sand mixed together. There is another, though smaller area of soft bottom near the middle of the northern boundary of the section. On the shoals the bottom is of sand, more or less hard, according to the depth of water. In Parched Corn Bay the bottom is hard mud in the middle and mud and sand about the edges. In Stumpy Point Bay soft mud predominates, and for about a mile to the southward of Stumpy Point a sandy bottom will be found.

While the general character of the bottom is hard, there are numbers of small tracts scattered over the area which have soft, muddy bottoms, or mud on top of a sandy stratum. In the neighborhood of the oyster beds the bottom is usually soft.

*Specific gravity:* The average density is 1.0124; the greatest 1.0147, and the least 1.0092, were observed in October, within a few days of each other. The observations in April showed a density of 1.0100. The general range of density is, however, slight, a large number of observations giving about 1.0120 as a result. The influence of New and Hatteras Inlets begins here

to be apparent, and the specific gravity remains more stable than in Section I.

*Oyster beds:* The areas and positions of these are laid down on the accompanying map. It will be seen by reference to it that several small beds are indicated as existing in the eastern and southeastern portions of the section. These can hardly be considered "beds," as they are mere lumps of shells and oysters, of so small an area that it was difficult to find them with the poles and had not the chain been in use they would have been missed altogether. In Parched Corn Bay and about Long Shoal Point are several beds of considerable importance, principally on account of the ease with which they are worked and the sheltered locality in which they lie. They are, however, being slowly destroyed by over fishery. About two miles southeast from Sandy Point are a number of beds in 12 to 14 feet of water, some of which are of considerable size and importance. The oysters grow on them in lumps and clusters and show the usual inferiority due to over crowding. A little over 3 miles E. S. E. of Stumpy Point is quite a large bed presenting the same characteristics, and  $4\frac{1}{2}$  miles due east of Stumpy Point, on the edge of the channel, is another bed of considerable area, which has been but little worked. The remaining beds shown on the map are small and unimportant.

There is very little work done on any of these areas, except those about Long Shoal Point and off Sandy Point, the water being too deep for the use of tongs. Moderate dredging on the beds would increase their size and improve the oysters. There are no artificial beds in the section, and no enemies of the oyster were observed. The currents set to the northward and southward with the winds. The average velocity is  $\frac{1}{4}$  knot per hour. The maximum velocity observed, was  $\frac{1}{2}$  knot. After heavy rain storms, there is a set of fresh water from Stumpy Point Lake (now a bay), but with that exception no fresh water, other than that derived from Albemarle Sound, enters the section.

I regard this section as offering a very good field for oyster culture. The bottom is generally suitable, with the exception

of the high sand shoal off Long Shoal Point, the shoal ground in Sandy Bay and the long sand shoal making to the southward from Stumpy Point. The area included in these several exceptions is but 2,800 acres. The water is of a sufficiently high specific gravity, though there is some danger to be apprehended from freshets. The currents are strong enough to bring food to the animals, if not sufficient to prevent the deposit of sediment, and finally the numerous natural beds would supply spat as well as brood oysters for the artificial beds established in the vicinity. Stumpy Point Bay and Lake would probably prove good ground for the temporary deposit of marketable oysters for fattening purposes. Taking out the area deemed unsuitable, 2,800 acres, the area now occupied by natural beds, 850 acres, there remains over 79,000 acres, which now yield nothing, but can in all probability be made to produce a good marketable oyster.

#### SECTION V.

*Description:* Begins at the U. S. C. S. triangulation point known as "King's Point," in Lat.  $35^{\circ} 16' 12''.26$  N. and Long.  $75^{\circ} 36' 09''.26$  W., thence running N.  $54^{\circ} 20'$  W. (true)  $8\frac{1}{4}$  miles, more or less, to a point at the intersection of this line with a line running N.  $50^{\circ} 45'$  E. (true) to the U. S. C. S. triangulation point, known as "Gull Island," in Lat.  $35^{\circ} 28' 37''.82$  N. and Long.  $75^{\circ} 31' 29''.17$  W., the said point being the corner of Section IX.; thence running along said line N.  $50^{\circ} 45'$  E. (true) 14 miles, more or less, to the said "Gull Island" triangulation point, thence running S.  $64^{\circ} 45'$  E. (true)  $2\frac{1}{4}$  miles, more or less, to the intersection of said line S.  $64^{\circ} 45'$  E. (true) with the shore line, thence along the western shore line of Hatteras Bank to the beginning, containing, more or less, 60,626 acres.

This section has only been superficially examined, and though of large area, most of which appears to be favorably situated for oyster culture, more detailed examination may modify the opinions now entertained regarding it.



*Depth of water:* About one-half the section is occupied by the large sand shoal making out to the westward for about 4 miles from Kinnakeet and Hatteras Banks. Over this shoal the water varies greatly in depth, ranging from 1 to 10 feet. Many tracts of considerable area having a uniform depth of 8 and 10 feet can be found, while between them much larger areas of comparatively high shoal exist. A large tract of very shoal water lies between Little Kinnakeet and Gull Island, and another lies southwest of Little Kinnakeet, northwest of Kinnakeet and about 2 miles from the shore. The remaining very shoal areas are small, the general depth of water, except in the slues, ranging from 3 to 4 feet. A deep slue  $2\frac{1}{2}$  miles long and  $\frac{1}{4}$  mile wide lies a little off the shore to the southward and westward of Kinnakeet another called the "Cape Channel," makes in from the deep water in an E. by S. direction for  $3\frac{1}{2}$  miles, and is over one-half mile wide; and a large area with a depth of 8 feet lies in the southeast corner of the section, near King's Point. Other similar, but smaller tracts are scattered about over the plateau.

This breaking up of the shoal probably so disturbs the sea that there is a possibility that any oysters deposited on the bottom would not be covered by moving sand. Experiments, however, are needed to decide the question. The western half of the section lies in deep water of from 14 to 18 feet.

*Character of bottom:* On the shoal lying in the eastern half of the section the bottom is of sand, except in the slues and deep water areas, where it is a mixture of sand and mud, and occasionally of mud alone. The higher the shoal the harder the bottom. The western half of the section, where the water is deep, has a bottom somewhat similar to that described in section IV, though there is a larger proportion of mud. In the neighborhood of the shoal the bottom is hard; as the western boundary is approached, it becomes softer, consisting of fine sand and mud.

*Specific gravity:* In advance of the detailed examination of this section it is impossible to speak decisively as to the density of the water; a specific gravity of 1.0120 to 1.0130 is indicated as probable.

No oyster beds are reported to exist in the section, though a few scattered groups are occasionally found along the shore. Lack of time and the inclemency of the weather prevented a search for beds, and the statements of the fishermen had to be accepted. No currents were measured, but they are probably sluggish, with a general set towards Hatteras Inlet. Without more careful examinations and greater information than is at present at my disposal, it is difficult to speak positively as to the probabilities in this section. The indications are that a large portion of the area can be utilized for oyster culture. Certainly that portion lying west of the shoals and also the large areas with deep water lying in the eastern half. Possibly portions of the shoal itself can be utilized. The area of very shoal ground which is certainly unsuitable is 9,400 acres, and of the remaining 51,000 acres it is possible that 10,000 may be unfit. I think that it is within the limits to assign 41,000 acres to this section as suitable, with a possible expansion of this area to 50,000 acres.

#### SECTION VI.

*Description:* Begins at the U. S. C. S. triangulation point known as "Gull Island," in Lat.  $30^{\circ} 28' 37''.82$  N., and Long.  $75^{\circ} 31' 29''.17$  W., thence running S.  $50^{\circ} 45''$  W. (true) 14 miles, more or less, to a point at the intersection of this line with a line drawn from the U. S. C. S. triangulation point known as "King's Point," in Lat.  $35^{\circ} 16' 12''.26$  N., and Long.  $75^{\circ} 36' 09''.26$  W. to the U. S. C. S. triangulation point known as "Gibb's Point," in Lat.  $35^{\circ} 29' 38''.47$  N., and Long.  $75^{\circ} 57' 42''.19$  W., the same being the corner of Sections VIII and IX, thence with said line from "King's Point" to "Gibb's Point," N.  $54^{\circ} 20'$  W. (true)  $13\frac{1}{4}$  miles, more or less, to a point at the intersection of said line with a line drawn N.  $59^{\circ} 30'$  E. (true) to Long Shoal Light House, in Lat.  $35^{\circ} 33' 23''$  N., and Long.  $75^{\circ} 42' 16''$  W., the said point being the corner of Sections X and IX, thence running N.  $59^{\circ} 30'$  E. (true)  $12\frac{1}{4}$  miles, more

or less, with said line to a point at the intersection of said line with a line drawn from the U. S. C. S. triangulation point known as "Long Shoal Point," in Lat.  $35^{\circ} 34' 34''.53$  N., and Long.  $75^{\circ} 46' 54''.59$  W., to the aforesaid U. S. C. S. triangulation point on Gull Island, the said point of intersection being the corner of Section VII, thence with said line S.  $64^{\circ} 45'$  E. (true)  $12\frac{1}{8}$  miles, more or less, to beginning, containing, more or less, 95,776 acres.

This section, while very large, is unimportant, nearly the entire area being unfit for oyster culture; and on that account it has been but superficially examined.

*Depth of water:* This is generally uniform, ranging from 18 to 20 feet. In the Northeastern corner, about 4 miles from Gull Island, the water shoals gradually to 8 feet at  $\frac{1}{4}$  mile from the island; and in the Northwestern corner, in the neighborhood of Long Shoal, there is a small tract with an average depth of 14 feet.

*Character of bottom:* This is of soft mud mixed with fine sand and in places with finely broken shells. In the Northeastern corner where the water begins to decrease in depth, the bottom gradually changes with the depth, to hard sand. In the Northwest corner, near Long Shoal, it is also of hard sand.

*Specific gravity:* The average for the section is 1.0137.

There are no oysters of any kind within the section.

The currents set with the wind with a velocity depending upon its force. A slow set to the Southward exists in calm weather.

The soft nature of the bottom will prevent the greater portion of this otherwise admirably situated area from being utilized. It is by no means impossible to raise oysters on such bottoms; indeed, if properly prepared, they form excellent ground. But the expense of preparation, which is essentially the solidifying of the bottom, is too great to encourage the undertaking in these localities. With the exception then of the shoal tracts in the Northeast and Northwest corners and a small area in the Southeast corner, as indicated on the maps, the section must be considered as unsuitable. The area of these excepted tracts is 15,300 acres, upon which excellent oysters can be grown.



SECTION VII.

*Description:* Begins at the U. S. C. S. triangulation point known as "Gibb's Point," in Lat.  $35^{\circ} 29' 38''.47$  N., and Long.  $75^{\circ} 57' 42''.19$  W., thence running along shore line of the main land to the U. S. C. S. triangulation point known as "Long Shoal Point," in Lat.  $36^{\circ} 34' 34''.53$  N., and Long.  $75^{\circ} 46' 54''.59$  W., thence running S.  $64^{\circ} 45'$  E. (true)  $4\frac{1}{8}$  miles, more or less, to a point at the intersection of this line with a line drawn S.  $59^{\circ} 30'$  W. (true) from Long Shoal Light House, in Lat.  $35^{\circ} 33' 23''$  N. and Long.  $75^{\circ} 42' 16''$  W., the said point of intersection being the corner of Section VI; thence running S.  $59^{\circ} 30'$  W. (true)  $12\frac{1}{4}$  miles, more or less, to a point at the intersection of said line S.  $59^{\circ} 30'$  W. (true) with a line drawn from the U. S. C. S. triangulation point, "King's Point," in Lat.  $35^{\circ} 16' 12''.26$  N., and Long.  $75^{\circ} 36' 09''.26$  W., to the aforesaid triangulation point, "Gibb's Point," the said point of intersection being the corner of Sections VI, IX and X, thence with said line from "King's Point" to "Gibb's Point," N.  $54^{\circ} 20'$  W. (true) 4 miles, more or less, to the beginning, containing more or less, 43,038 acres.

This section is an important one, comprising as it does the famous oyster grounds in Far and Waupoppin creeks, Long Shoal River and Pains Bay.

*Depth of water:* This ranges from 17 feet, along the eastern boundary of the section, to 2 feet along the shores. About 2 miles off shore 14 feet will be found, from which line the water shoals gradually to 6 feet within a half-mile of the marsh. Inside of the 6 foot line the shoal is more abrupt. At the mouth of Long Shoal River, a long, high shoal with 1 to 2 feet of water over it, known as Pingleton Shoal, makes out from the middle of the river, to the southward and eastward for about two miles. In Far and Waupoppin creeks, the depth of water is about 2 feet; in the Long Shoal River, from 4 to 8 feet, and in Pains Bay, an arm of Long Shoal River, 4 feet.

*Character of bottom:* In the deep water of the Sound, the bottom is soft, consisting of mud. As the shore is approached, this mud becomes harder and is mixed with sand, so that within the 12 foot curve the bottom is sticky, consisting of hard mud and sand, interspersed with small areas of hard sand. Inside the 6 foot curve hard bottom is found to a greater extent and with a good deal of grass growing over it. In Far and Waupoppin creeks, the bottom is soft and sticky, consisting of a layer of mud 3 inches thick over sand, with hard sand near the shores. In Long Shoal River the bottom near the shore is somewhat similar, but is softer in the middle. Pains Bay is soft or sticky, consisting of mud and fine sand.

At this date, the survey of Long Shoal River and tributaries is not completed and it is impossible to give many details regarding that area.

*Specific gravity:* The average density for the section is 1.0125. The least density observed, 1.0116, was off the mouth of Long Shoal River during light westerly winds. The greatest density, 1.0142, was about the middle of the section during strong south-westerly winds. The density in Far Creek is 1.0120; in Waupoppin Creek, 1.0119; in Oyster Creek, 1.0124, and off the mouths of these creeks, 1.0128.

Density observations have not yet been obtained for Long Shoal River and its tributaries; but as a density varying from 1.0116 to 1.0123, was found at the mouth of the river, it may be assumed that that range of specific gravity will not be exceeded within the river itself, except about its head.

The peculiarly high specific gravity of this section appears at first to be anomalous, as it is about as distant from the salt water supply as any in the Sound. It is probably due, however, to the shelter from the Albemarle current, afforded by the long shoal off Long Shoal Point, which appears to divert the fresh water somewhat to the eastward and in the direction of Hatteras Inlet.

*Oyster Beds:* While these are not very numerous, they are important on account of their superiority to the usual growth, the

Far Creek oysters having a deservedly high reputation. Most of these high grade oysters come from the "gardens" or planted grounds, though a number are still found in and off the creek. The original beds have to a great extent disappeared, either through over fishery or natural causes, and the oysters now found are few and far between, a man and boy experiencing difficulty in obtaining two bushels a day. This very scarcity, due to the scattering of the oysters has, however, so much improved the oysters that they bring high prices, especially as all are old, probably the survivors of the original "rocks."

There is a small bed off Gibb's Point, and a large one on the Pingleton Shoal that are still productive, and in and about the marshes at the mouth of Long Shoal River are a few small beds or scattered lumps of oysters which are not of great importance and have not yet been located. The entire area of natural beds in the section does not exceed 230 acres. The Pingleton Shoal bed is being destroyed rapidly by over fishery, and the oysters even at present, are both scarce and of inferior quality. The artificial beds or "oyster gardens," of which there are 21 in the section, comprising about 165 acres, are located principally in Far Creek and its tributaries. A few lie in Pains Bay, but none at all in the Sound. In many of these gardens the oysters thrive admirably and they would do better in all, had a better stock for planting been selected. No one has made any effort to catch the young oysters or spat by exposing collectors, or to do anything beyond transplanting the oysters from the natural to the artificial grounds, which is the crudest form of cultivation.

The currents in this section are variable and sluggish, setting with the wind with a low velocity. Out of the Long Shoal River there is a slight set during calm weather, but no sufficient fall exists anywhere along the shores to make a current of such rapidity as would have any particular effect.

Section VII is so admirably situated, and has already so high a reputation for its oysters that probably, in time, the whole of it will be utilized. But a large proportion of its bottom is so soft that considerable expense will have to be

incurred before it can be made available. I have therefore excluded those areas lying in deeper water than 14 feet from consideration, deeming them at present unfit for oyster culture. I also consider the high shoal, known as Pingleton Shoal, the shoal off the southern point of Pains Bay, and the shoal lying along the marsh from the entrance to Long Shoal River to Long Shoal Point, as unsuitable. Remaining is the area of Pains Bay 1148 acres, of Long Shoal River, 2816 acres, of the bay between Shad and Pingleton Points, 807 acres, of Far Creek and tributaries 729 acres, and the area in the Sound in less than 14 feet of water, 22,089 acres, or a total of 22,489 acres, which is suitable for oyster culture. Of this area 395 acres are occupied, leaving 22,094 acres unproductive.

#### SECTION VIII.

*Description:* Begins at a point on the western shore line of Ocracoke Island, at the intersection of said shore line with a line drawn from the U. S. C. S. triangulation point known as "Great Swash," in Lat.  $35^{\circ} 08' 53''.44$  N., and Long.  $75^{\circ} 52' 24''.79$  W., to the U. S. C. S. triangulation point known as "Hog Island," in Lat.  $35^{\circ} 21' 49''.58$  N., and Long.  $76^{\circ} 03' 40''.44$  W., thence running along said line from the "Great Swash" to "Hog Island" N.  $35^{\circ} 28'$  W., (true)  $2\frac{5}{8}$  miles, more or less, to a point at the intersection of said line with a line drawn from Royal Shoal Light House, in Lat.  $35^{\circ} 09' 19''$  N., and Long.  $76^{\circ} 09' 30''$  W., N.  $82^{\circ} 53'$  E. (true), the said point of intersection being the corner of sections XII and IX, thence running N.  $43^{\circ} 17'$  E. (true)  $15\frac{1}{4}$  miles, more or less, to a point at the intersection of this line with a line drawn from the U. S. C. S. triangulation point known as "King's Point," in Lat.  $35^{\circ} 16' 12''.26$  N., and Long.  $75^{\circ} 36' 09''.26$  W., to the U. S. C. S. triangulation point known as "Gibb's Point," in Lat.  $35^{\circ} 29' 38''.4$  N., and Long.  $75^{\circ} 57' 42''.19$  W., the said point of intersection being the corner of section IX, VI and V, thence running S.  $54^{\circ} 20'$  E., (true)  $8\frac{1}{2}$  miles, more or less, to the intersection of the shore line with the said line to "King's Point" triangulation point, thence from said intersection run-



ning along the western shore line of Hatteras and Ocracoke Islands and across Hatteras Inlet, to beginning, containing more or less 61,834 acres.

This section comprises the ground in the vicinity of Hatteras Inlet, and it is unfortunate that bad weather in September and the early part of October prevented its careful examination, for the indications are favorable for a large portion of the area.

*Depth of water:* The greater part of the section is occupied by shoals having less than 12 feet of water over them. To the southward and westward of the Inlet these shoals extend about three miles from shore and close to the western boundary line, and off Qualk Hammock the shoal is very high, the 2 foot curve being 2 miles from the land. To the northward and westward of the Inlet the shoals extend even farther, the 3 foot curve being 4 miles off Durant's Point. But in this direction the shoal is more or less broken, as described in section V.

Each shoal has a distinctive name which is familiar to all frequenters of that neighborhood, and a description of each is hardly necessary. The Bird Island or Clam Shoal, the Log Shoal, the Egg Shoal and Oliver's Reef form practically one large shoal with from 1 to 3 feet of water over it, extending from the northern boundary of the section, about four miles off shore, to the Oliver Reef Light House, and being about  $5\frac{1}{2}$  miles long and 1 mile wide.

Between this line of shoals and the shore is an area of comparatively deep water, the depth ranging from 5 to 12 feet. On the Southern side of the inlet there is also a deep water slue of from 6 to 10 feet, known as Guess Reef Channel, between the shoals and the Legged Lump and the shore; but it is of much less area than the tract to the northward. Due North of the inlet is a space about  $2\frac{1}{2}$  miles long and a mile or so wide, which is made up of lumps and bars between comparatively deep channels, formed by the rapid currents running in and out the Inlet. The depth of water ranges here between a few feet and several fathoms. To the westward of the shoals and between them and the western boundary line of the section, the

depth is fairly uniform, increasing gradually from 12 to 15 and 17 feet, the shoaler water being found to the southward. An inspection of the accompanying map will give a good idea of the contour of the bottom, especially outside the shoals.

*Character of bottom:* This is, for nearly the whole section, of sand. On the shoals it is hard; in the deep water it becomes somewhat softer and is mixed with a little mud; in the deep slues and areas between the shoals and the islands there is more mud, but it is only a superficial stratum, sand being found underneath. The section not having yet been subjected to detailed examination it is impossible to speak very positively on this subject.

*Specific gravity:* The average density for the section is 1.0148. The maximum density observed, 1.0157, was close to the Inlet; the minimum density, 1.0133, was near the western boundary.

*Oyster beds:* These have only been approximately located and are not of great importance. The total area is about 220 acres. South of the Legged Lump and half way between those islets and Qualk Hammock, on the western side of the Inlet and along the southern edge of the Guess Reef Channel, are several beds; to the northward and eastward of the Egg and Log Shoals and on the western side of the Log Channel are quite a number, and about Bird Island and Egg Shoal are several more. In the deep water in shore of these shoals there are a few oysters sparsely scattered; but outside the shoals in the Sound, no beds or oysters exist. No oyster gardens have been taken up within the limits of the section. No enemies of the oyster were found or heard of, but it is possible that the detailed survey may discover them. Probably both the star fish (*Asterias*) and the drills (*Urosalpinx cinereus* and allied forms) will be found here and about Ocracoke Inlet if anywhere; and the "conchs" (*Fulgur carica* and *sycotypus canaliculatus*) are known to be plentiful in both regions.

The currents in this section are regular and strong, especially about the Inlet where they average from one-half knot to a knot

per hour. The action is a tidal one, influenced more or less by the winds and flow of water from the Sound. The general set is to and from the Inlet.

I consider about two-thirds of this section as suitable ground for growing oysters, though, possibly, they would need transplanting in fresher water before being fit for market. The bottom is generally clean and hard, the specific gravity high, and the currents strong. It is possible, however, that the bottom outside the shoals will shift in heavy weather, and an experiment to decide that question has been made; but the result cannot be ascertained until the spring. The high shoals on either side of the Inlet and the shoal ground having less than 3 feet along the shores, I consider unsuitable from the liability of the bottom to shift and on account of the general disadvantages due to so slight a depth. Excluding those areas and that directly north of the Inlet where the bottom is so irregular in contour, there remains 48,300 acres that are probably fit for cultivation.

#### SECTION IX.

*Description:* Begins at the intersection of a line drawn from the U. S. C. S. triangulation point, known as "Great Swash," in Lat.  $35^{\circ} 08' 53''.44$  N., and Long.  $75^{\circ} 52' 24''.79$  W., to the U. S. C. S. triangulation point, known as "Hog Island," in Lat.  $35^{\circ} 21' 49''.58$  N., and Long.  $76^{\circ} 03' 40''.44$  W., and the line drawn N.  $82^{\circ} 53'$  E. (true), from the Royal Shoal Light House, in Lat.  $35^{\circ} 09' 19''$  N., and Long.  $76^{\circ} 09' 30''$  W., the said point of intersection being the corner of Sections XII and VIII, thence running N.  $35^{\circ} 28'$  W. (true),  $12\frac{3}{8}$  miles, more or less, along said line from the "Great Swash" triangulation point, to the "Hog Island" triangulation point, the same being the corner of Section XIII, thence running N.  $37^{\circ} 40'$  E. (true),  $11\frac{1}{2}$  miles, more or less, to a point at the intersection of this line, N.  $37^{\circ} 40'$  E. (true), with a line drawn from the U. S. C. S. triangulation point, known as "Gibb's Point," in Lat.  $35^{\circ} 29' 38''.44$  N., and Long.  $75^{\circ} 57' 42''.19$  W., to the U. S. C. S. triangulation point, known as "King's

Point," in Lat.  $35^{\circ} 16' 12''.26$  N., and Long.  $75^{\circ} 36' 09''.26$  W., the said point of intersection being the corner of Sections X, VII, and VI, thence running S.  $54^{\circ} 20'$  E. (true)  $13\frac{1}{4}$  miles, more or less, with said line from "Gibb's Point" to "King's Point" triangulation points, to a point at the intersection of said line with a line drawn N.  $50^{\circ} 45'$  E. (true), to the U. S. C. S. triangulation point known as "Gull Island," in Lat.  $35^{\circ} 28' 37''.82$  N., and Long.  $75^{\circ} 31' 9''.17$  W., the said point of intersection being the corner of Sections VI, V and VIII, thence running S.  $43^{\circ} 17'$  W., (true)  $15\frac{1}{4}$  miles, more or less, to the beginning, containing, more or less, 103,270 acres.

This section, which like Section VI, lies in the middle of the Sound, while comprising an unusually large area is not of great importance, as but a comparatively small portion of it is suitable for oyster culture.

*Depth of water:* This is generally about 20 feet. Along the eastern boundary of the section is a tract about 12 miles long and from  $1\frac{1}{2}$  to 2 miles wide, where the depth ranges from 14 to 18 feet; and as the western boundary is approached the depth also decreases to 17 and 18 feet. About the middle of that boundary a portion of the Gull Shoal having from 7 to 10 feet over it and extending from the boundary S. E.  $1\frac{1}{2}$  miles, is found; and about E. S. E. from the point of the Gull Shoal for 2 miles further is water of from 12 to 17 feet. In the middle of the section 23 to 24 feet is the general depth.

*Character of bottom:* Along the eastern boundary, on the comparatively shoal space already described, the bottom is of sand with finely broken shells. Along the western boundary, on the Gull Shoal, and in its neighborhood, the bottom is also of sand with considerable areas of mixed sand and mud, forming a sticky or tenacious upper stratum. Ground of this character will be found along the western boundary  $1\frac{1}{2}$  miles from the N. W. corner, extending about 5 miles and varying in width from 1 to  $4\frac{1}{2}$  miles. In the deep water in the middle of the section the bottom is of soft, blue mud, mixed with broken shells.



*Specific gravity:* This is practically uniform for the whole section. The least density was 1.0125 and the greatest 1.0139. The average is 1.0133.

Northerly winds diminish and southerly and easterly winds increase the specific gravity.

There are no oysters in this section.

The currents are sluggish and are principally due to the wind; a slight set in the direction of Hatteras Inlet is found about the eastern portion of section.

The character of the bottom (soft mud) will prevent the greater part of this section from being utilized, except at great expense. Otherwise, it is admirably situated, having a good depth and the right specific gravity of the water. The comparatively shoal ground along the eastern and western boundaries, where the bottom is hard, or sufficiently so to support the oysters, is, however, well adapted to cultivation. This area amounts to 32,980 acres.

#### SECTION X.

*Description:* Begins at the U. S. C. S. triangulation point known as "Gibb's Point," in Lat.  $35^{\circ} 29' 38''.47$  N., and Long.  $75^{\circ} 57' 42''.19$  W., thence running S.  $54^{\circ} 20'$  E. (true) 4 miles, more or less, along a line drawn from the said "Gibb's Point" to the U. S. C. S. triangulation point known as "King's Point," in Lat.  $35^{\circ} 16' 12''.26$  N., and Long.  $75^{\circ} 36' 09''.26$  W., to the intersection of said line with a line drawn from Long Shoal Light House, S.  $59^{\circ} 30'$  W. (true), the said point of intersection being the corner of sections VI, VII and IX, thence running S.  $37^{\circ} 40'$  W. (true),  $11\frac{1}{2}$  miles, more or less, to a point at the intersection of this line S.  $37^{\circ} 40'$  W. (true), with a line drawn from the U. S. C. S. triangulation point known as "Great Swash," in Lat.  $35^{\circ} 08' 53''.44$  N., and Long.  $75^{\circ} 52' 24''.79$  W., to the U. S. C. S. triangulation point, known as "Hog Island," in Lat.  $35^{\circ} 21' 49''.58$  N., and Long.  $76^{\circ} 03' 40''.44$  W., the said point of

intersection being the corner of sections IX, XII and XIII, thence running N.  $35^{\circ} 28'$  W. (true)  $3\frac{1}{4}$  miles, more or less, to the said "Hog Island" triangulation point, thence in the same direction across Hog Island to the mainland, thence with the shore line of the mainland to beginning, containing, more or less, 30,291 acres.

While this is not a very large section it is an important one on account of facility with which oysters can be raised in it. It comprises the region lying between Gibb's Point or Far Creek and Hog Island, and includes Wysocking Bay and its tributaries, 3,727 acres, and Middleton Anchorage or Bay, with its tributaries, 1,002 acres.

*Depth of water:* This is very irregular, especially about the mouth of Wysocking Bay. A long "T" shaped shoal with from 3 to 6 feet of water on it makes out east from Hog Island Point about  $2\frac{1}{4}$  miles. The head of the "T" is at this outer extremity and is about 2 miles long, extending N. N. E. and S. S. W., and  $\frac{1}{2}$  mile wide. Another shoal, with from 3 to 6 feet over it, makes out to the southward and eastward  $2\frac{1}{4}$  miles from Long Point, the northern entrance to Wysocking Bay. About  $3\frac{1}{2}$  miles to the southward of Middleton Creek is a shoal (Gull Shoal?) with an average depth of 4 feet,  $\frac{1}{3}$  of a mile wide, and extending  $2\frac{1}{2}$  miles S. E. from the shore. Off Gibb's Point the Gibb's Shoal, having from 2 to 4 feet over it, extends  $2\frac{1}{2}$  miles to the southward and eastward. Between the shoals in Wysocking Bay the depth is from 2 and 4 feet along the shores to 8 and 10 feet in the bay; between Long Point Shoal and the Gull Shoal the depth is from 7 to 12 feet, and between the Gull Shoal and Gibb's Shoal from 8 to 15 feet will be found. The narrow strip of bottom lying between the shoals and the western boundary of the section has over it about 14 feet.

*Specific gravity:* The density of the water outside the bays and creeks is 1.0138. That within the creeks has not yet been determined, but there is no reason to suppose that it will fall below 1.0120.

*Oyster beds:* Detailed surveys have not yet been made in Wysocking Bay or to the southward of Middleton Anchorage. The positions and areas given of the oyster beds are therefore but approximations. About Hog Island and between Hog Island and Hog Island Point are a number of small beds and scattered groups of oysters; in Mt. Pleasant Bay the beds are about of the same character; in the middle of Wysocking Bay and between Hog Island and Long Point there are numbers of beds of good size—one in particular—the “Gull Rock,” being quite large. Oysters also are found in the several creeks and occasionally along the marshes, but the exact location of these unimportant areas has not yet been attempted. The approximate area occupied by beds is 434 acres, which is probably in excess of the real amount. There are five “oyster gardens” of record, located in Wilson’s, Middle and Cypress Creeks. Their area is in the aggregate  $22\frac{3}{4}$  acres. Altogether the natural and artificial beds of the section occupy less than 260 acres.

Until more thorough examinations are made in this section, it is impossible to say whether the usual enemies of the oyster flourish here or not; but there is no probability of finding them in excessive numbers even should they exist. No measurements of currents have yet been made but the indications are that they do not differ materially from those in section VII, being probably more sluggish, if anything, than in that section.

I regard nearly the whole of this area as admirably adapted for oyster culture. With the exception of a few shoals and a few areas which are soft, the bottom is firm and well protected, as is section VII, from the heavy gales, by the long shoals extending to the southward and eastward from the shores. The water is of the right specific gravity and nature has already made successful experiments in growing oysters which should be conclusive. Excepting the Gibbs’ Shoal and one or two shoals in Wysocking Bay, the remaining area of 29,900 acres offers no natural obstacle to oyster culture.

## SECTION XI.

*Description:* Begins at the U. S. C. S. triangulation point known as "Camp Point," on Hog Island, in Lat.  $34^{\circ} 59' 51''.1$  N., and Long.  $76^{\circ} 14' 37''.2$  W., thence running N.  $24^{\circ} 08'$  E. (true) 12 miles, more or less, to the Royal Shoal Light House, in Lat.  $35^{\circ} 09' 19''$  N., and Long.  $76^{\circ} 09' 30''$  W., thence running N.  $82^{\circ} 53'$  E. (true)  $14\frac{1}{2}$  miles, more or less, to a point at the intersection of this line N.  $82^{\circ} 53'$  E. (true) with a line drawn through the U. S. C. S. triangulation points "Hog Island," in Lat.  $35^{\circ} 21' 49''.58$  N., and Long.  $76^{\circ} 03' 40''.44$  W., and "Great Swash," in Lat.  $35^{\circ} 08' 53''.44$  N., and Long.  $75^{\circ} 52' 24''.79$  W., the said point of intersection being the corner of Sections VIII, IX and XII, thence running S.  $35^{\circ} 28'$  E. (true)  $2\frac{3}{8}$  miles, more or less, along said line from "Hog Island" triangulation point to the "Great Swash" triangulation point, to the shore, thence following the western shore line of Ocracoke and Portsmouth Islands across Ocracoke Inlet to a point where a line from the beginning, at "Camp Point," to the U. S. C. S. triangulation point known as "Wade," in Lat.  $34^{\circ} 58' 58''.93$  N., and Long.  $76^{\circ} 09' 11''.2$  W., intersects the shore of Core Banks, thence from said point of intersection N.  $78^{\circ} 58'$  W. (true)  $5\frac{1}{8}$  miles, more or less, to the beginning, containing, more or less, 76,570 acres.

This section includes the region about Ocracoke Inlet and is important, not only on account of its size, but because of the active oyster fishery now prosecuted within its limits.

*Depth of water:* As in the neighborhood of Hatteras Inlet, this is very irregular, a large portion of the section being occupied by shoals. From the southern boundary not more than 3 to 4 feet will be found for over a mile to the northward, except in Wainwright Slue, an indentation in the shoal, which makes an excellent anchorage. To the northward and westward of Core Beach or "Banks," a similar shoal with from 2 to 4 feet of water makes out for over  $2\frac{1}{2}$  miles. It is bounded on the northward by a slue having 7 feet of water, which extends to the north-



ward and westward from the now closed Whalebone Inlet. Between Whalebone Inlet and Portsmouth, 3 and 4 feet of water will be found for about  $1\frac{1}{2}$  miles from the shore; but about the middle of Portsmouth Island this depth extends in a long, tongue-shaped shoal,  $\frac{1}{4}$  to  $\frac{3}{4}$  of a mile wide, for fully 3 miles.

Northwest of Portsmouth and of Ocracoke Inlet the depth is very irregular, ranging from 1 to 20 feet. The shoals here take up the greater part of the area, the channels and slues being narrow and tortuous, though deep. The Royal Shoal, lying about 6 miles northwest of Portsmouth, is  $2\frac{3}{4}$  miles long, extending in a northeasterly and southwesterly direction, and about a mile wide; over it is from 2 to 4 feet. It is connected with the great body of shoals lying in the entrance to the Inlet by a shoal  $2\frac{1}{2}$  miles long and  $\frac{1}{2}$  mile wide. Over this connecting tract the water is from 1 to 5 feet deep. About the several marshy islets, Mount Vernon Rock, Shell Castle, North Rock, Beacon Island and Casey's Island, the depth is inconsiderable, ranging from 1 to 3 feet.

Northwest of Ocracoke Light House the Swash channel makes out from Ocracoke Island, and separates the shoals to the southward from those to the northward of the Inlet. This channel is narrow and has but 8 to 12 feet of water in it, and at certain points and times considerably less. North of Ocracoke Island and from 1 to  $1\frac{1}{2}$  miles from the shore, is a line of shoals extending towards Hatteras Inlet, known as Howard's Reef and Clark's Reef. Their average width is about  $\frac{3}{4}$  mile, and the depth of water over them is from 1 to 3 feet. Inside these shoals is an area  $3\frac{1}{4}$  miles long and  $\frac{1}{2}$  mile wide, in which there is from 5 to 10 feet of water. Outside the general line of shoals and between them and the boundary lines drawn from the Royal Shoal Light House, the average depth is from 7 to 15 feet, the least water being along the shoals and thence gradually deepening towards the western limit of the section. An inspection of the accompanying maps will give a good idea of the depth of water in this region.

*Character of bottom:* This is generally sandy, hard on the shoals, and slightly less so in the deeper water. In the slues,

channels and deep areas, there is more or less mud, which is sometimes too soft to support oysters. On the tract lying between the slue making in towards Whalebone Inlet and the long tongue of shoal off the middle of Portsmouth Island, is an area of about 400 to 500 acres in 13 to 18 feet of water, which has a soft, muddy bottom. That lying to the southward of, and partly inclosed by the Royal Shoal, containing about 2,500 acres, has a bottom composed of mud and sand, the latter predominating as the shoal is approached. The deeper the water in this area the softer the bottom. In the channel ways between the shoals, soft and hard sand and occasional patches of mud are found. These bottoms, as also do the shoals, continually shift under the influence of the strong currents and heavy winds. Between Howard's Reef and the shore the bottom is sticky, consisting of soft sand and mud mixed, and in places separated. Between the line of shoals and the western and northern boundaries, the bottom is generally of sand, areas of mud occasionally being found. About and on the shoals, especially on each side of the Inlet, grass grows plentifully, and a little sponge was also found.

*Specific gravity:* The average for the section is 1.0148, but the density varies very much even in the same locality. Near the Royal Shoal Light House the range is from 1.0097 to 1.0109, and the average 1.0103. In the mouth of the Inlet the range is from 1.0146 to 1.0227, and the average 1.0197. To the northward and westward of Howard's Reef the range is from 1.0100 to 1.0150, with an average of 1.0130. In Wainwright Slue and about the southern limits of the section, the range is from 1.0093 to 1.0142, and the average 1.0108. In all these localities easterly winds increase the density and westerly winds decrease it. Rainy weather has a much less effect than would be supposed, as is shown by the observations in the latter part of August, after the heavy rains of that month and the observations in September. A N. E. wind has the most effect on the density, as the water is then driven in through the Inlet.

*Oyster beds:* The beds of this region are probably the most important in the State, furnishing as they do the principal sup-

ply for the New Berne market. Only one bed is found in the southern portion of the section. It lies near Wainwright slue, and comprises an area of about 13 acres. Formerly its oysters were of good quality and plentiful; but they have deteriorated and the supply has been exhausted by over fishery.

Most of the beds are in the neighborhood of Portsmouth, lying on the shoals between Beacon Island and North Rock, and Portsmouth Island and Mount Vernon Rock. The stock has a good reputation, but is being exhausted. A number of small, unimportant beds lie between Ocracoke Island and Howard's and Clark's Reef. They have not yet been instrumentally located. On the Royal Shoal, about one-third of a mile southeast from the Royal Shoal or Northwest Light House, is a large bed lying in from 1 to 3 feet of water, and comprising an area of about 100 acres. Only a part of this area is solid "rock," however; and though many fine oysters have been obtained from it in the past, it has been almost destroyed by excessive fishery.

The total area of oyster beds in the section is 520 acres. No enemies other than the "conchs" or "periwinkles" (*Fulur carica* and *sycoctypus canaliculatus*) have been noticed or heard of in the vicinity, though it is possible that more extended investigations will discover both the drills (*urosalpinx*) and star-fish (*asterias*). The majority of the oysters found were rather inferior in size, owing, probably, to the overcrowding they experience on the natural beds. There are 9 "oyster gardens," aggregating 90 acres, in the section, all lying about Portsmouth. The currents, especially about the Inlet, are strong and regular, being due to the ordinary tidal action. About the Royal Shoal the set is, as usual in the Sound, with the wind, varying in velocity from  $\frac{1}{4}$  to  $\frac{1}{2}$  knot per hour. In the neighborhood of the Inlet the set is to and from that opening with a velocity depending upon the state of the tide and wind, but averaging about one knot per hour. In the deep channels it will, on occasions, considerably exceed this rate. At the southern extremity of the section the current sets in and out of Core Sound at the rate of from  $\frac{1}{4}$  to  $\frac{3}{4}$  knot per hour.

I consider a large portion of Section XI as suitable ground for oyster culture. It will be observed that the bottom generally, is hard enough to support the oysters; the currents rapid and the specific gravity sufficiently high; and though the last varies considerably in certain portions of the section, these variations are not so great as to be injurious. To the northward of the Inlet and to the eastward of the Royal Shoal there is some danger of shifting bottom, and the same difficulty may be apprehended on the shoals and in their immediate neighborhood. Inside of Howard's Reef should be good ground, and between the Royal Shoal and the southern boundary and west of the Banks is a large and excellently situated area. The shoals, where the water is less than three feet, should be avoided and are deemed unsuitable on account of the extremes of heat and cold to which the oyster would be subjected, and the liability of the bottom to shift. It is true that the oyster beds lie on these shoals, but the beds are now composed of a solid mass of shells, the accumulation of ages, and the oysters are crowded on the area much more closely than they would be on any artificial ground. The sand has therefore but little chance to move.

Excluding the sand shoals and the channels in the immediate vicinity of the Inlet, the area of suitable bottom in the section is 59,100 acres.

#### SECTION XII.

*Description:* Begins at the Royal Shoal Light House, in Lat.  $35^{\circ} 09' 19''$  N., and Long.  $76^{\circ} 09' 30''$  W., thence running N.  $0^{\circ} 52'$  E. (true)  $8\frac{1}{2}$  miles, more or less, with a line drawn from the said Royal Shoal Light House to the U. S. C. S. triangulation point known as "Bluff Point," in Lat.  $35^{\circ} 19' 30''.47$  N., and Long.  $76^{\circ} 09' 26''.97$  W., to the corner of Sections XIII, XV and XVI, thence running N.  $64^{\circ} 47'$  E. (true)  $7\frac{1}{2}$  miles, more or less, to a point at the intersection of said line N.  $64^{\circ} 47'$  E. (true) with a line drawn from the U. S. C. S. triangulation point known as "Hog Island," in Lat.  $35^{\circ} 21' 49''.58$  N., and Long.  $76^{\circ} 03' 40''.4$  W., to the U. S. C. S. triangulation point known



as "Great Swash," in Lat.  $35^{\circ} 08' 53''.44$  N., and Long.  $75^{\circ} 52' 24''.79$  W., the said point of intersection being the corner of Sections X, IX and XIII, thence running S.  $35^{\circ} 28'$  E. (true)  $12\frac{3}{4}$  miles, more or less, along said line from "Hog Island" to "Great Swash," to a point at the intersection of said line with a line drawn from aforesaid Royal Shoal Light House, N.  $82^{\circ} 53'$  E. (true), thence running along said line S.  $82^{\circ} 53'$  W. (true)  $14\frac{1}{2}$  miles, more or less, to the beginning, containing, more or less, 67,738 acres.

This section is somewhat similar to Sections VI and IX, lying as they do, in the middle of the Sound and comprising a large area. It differs from those sections in having shallower water and a larger area which is suitable for cultivation.

*Depth of water:* Generally the water is deep—ranging from 14 to 22 feet and being over the greater part of the section more than 18 feet. Along the northern boundary the depth decreases to 8 and 12 feet, and in the southwestern corner, where lies a small portion of the Royal Shoal, from 4 to 10 feet will be found. Through the middle of the section, from the northern to the southern boundary, where it connects with the Royal Shoal, is the Bluff Shoal. It is 8 miles long, 1 mile wide, and has from 7 to 11 feet of water over it, the 7 foot patches lying in the northern central portion of the section.

*Character of bottom:* Generally this is of fine, gray sand. Occasionally the sand is mixed with broken shells, or soft, blue mud; and at several points all these constituents are found together. Along the eastern boundary, on a tract 5 miles long and  $2\frac{1}{2}$  miles wide, and along the western boundary on a tract  $4\frac{1}{2}$  miles long and 1 mile wide, soft, muddy bottom is found in from 20 to 22 feet of water.

*Specific gravity:* The average for the section is 1.0117. The maximum density observed was 1.0155; the minimum, 1.0091. Apparently the water to the eastward of the Bluff Shoal is of a considerably higher specific gravity than that to the westward. Additional observations are necessary, however, to determine this positively.

There are no oyster beds of any kind, nor any predatory shell-fish in the section. The currents are sluggish, and due principally to the action of the wind. During a strong gale from the northeast the current for several days was from  $\frac{1}{2}$  to  $\frac{3}{4}$  knot per hour, setting to the southwest. Probably this is the maximum velocity. During calm weather little or no current will be experienced, as the line of the Bluff Shoal is about the place of meeting of the flow from Albemarle and the northern portions of Pamlico Sound and that from the Pamlico River. Probably it is this meeting of currents with their suspended sediment that has formed and maintains the Bluff Shoal; and, indeed, the marked difference in the specific gravity on the two sides of that shoal appears to indicate that the water tested was of different origin.

With the exception of the two soft bottom areas along the eastern and western boundaries, amounting to 10,600 acres and already described, I consider the whole of Section XII as suitable ground, though it is possible that the bottom shifts on the Bluff Shoal. The probability of its doing so is not, however, sufficiently great to exclude the shoal from experiment; and one will be made in the future, should circumstances permit. The area adapted for oyster culture is, then, 57,000 acres.

#### SECTION XIII.

*Description:* Begins at a point at the intersection of the shore of the mainland with a line drawn from the U. S. C. S. triangulation point known as "Bluff Point," in Lat.  $35^{\circ} 19' 30''.47$  N., and Long.  $76^{\circ} 09' 26''.97$  W. to the Royal Shoal Light House, in Lat.  $35^{\circ} 09' 19''$  N., and Long.  $76^{\circ} 09' 30''$  W., thence running to the eastward along the shore of the mainland to the intersection of the shore line with a line drawn through the triangulation points known as "Great Swash" and "Hog Island," thence to the said U. S. C. S. triangulation point known as "Hog Island," in Lat.  $35^{\circ} 21' 49''.58$  N., and Long.  $76^{\circ} 03' 40''.44$  W., thence running S.  $35^{\circ} 28'$  E. (true)  $3\frac{1}{4}$  miles, more or less, along the line drawn from the said "Hog Island" triangulation point to the U.

S. C. S. triangulation point known as "Great Swash," in Lat.  $35^{\circ} 08' 53''.44$  N., and Long.  $75^{\circ} 52' 24''.79$  W., to the corner of Sections IX, X and XII, thence running S.  $64^{\circ} 47'$  W. (true)  $7\frac{7}{8}$  miles, more or less, to a point at the intersection of this line S.  $64^{\circ} 47'$  W. (true) with a line drawn from Royal Shoal Light House, in Lat.  $35^{\circ} 09' 19''$  N., and Long.  $76^{\circ} 09' 30''$  W., N.  $0^{\circ} 52'$  E. (true), to the aforesaid "Bluff Point" triangulation point, the said point of intersection being the corner of Sections XII, XV and XVI, thence running along said line N.  $0^{\circ} 52'$  E. (true)  $3\frac{1}{4}$  miles, more or less, to the beginning, containing, more or less, 15,746 acres.

This section, though small, is important for the same reason stated with regard to Section X; it can be so readily utilized, and is so favorably located.

*Depth of water:* This is very uniform, ranging from 8 to 10 feet.

*Character of bottom:* This also is generally uniform, consisting of sand and mud, which is hard or sufficiently so to support the oysters. A few isolated areas have a soft or sticky bottom, of mud or mud and sand mixed. One of these, the largest, is in East Bluff Bay, a locality of 1,200 acres, much of which is soft. Another soft area of several hundred acres lies near the southeastern corner of the section.

*Specific gravity:* Only a few observations have as yet been made, but they indicate an average density of about 1.0110, which probably decreases in the bays and creeks.

*Oyster beds:* There are a few small beds and scattered groups of oysters about Bluff Point and in East Bluff Bay. Other small beds lie about one mile to the eastward of Middle Point, and others again about Hog Island. As the section has not yet been subjected to more than a superficial examination, the positions and areas determined for these beds are only of approximate accuracy. A rather rough calculation gives 230 acres as the aggregate, which includes a tract lying near the southwest corner of the section,  $1\frac{3}{4}$  miles from Bluff Point, on which the oysters are scattered, and not in a solid "rock." No "oyster gardens"

have been taken up in the section. In advance of the detailed survey and examination, it is impossible to speak positively with regard to the quality of the oysters, the presence of enemies, or the strength and direction of the currents. There is no reason to anticipate any particular variation, however, from what has been noticed in similar localities, and probably the oysters will be found to be small and impoverished from crowding, enemies will be absent, and the currents will be sluggish and setting with the wind, with a velocity proportional to its force.

While subsequent investigation may modify my opinion, I see no reason to expect it to do so, but consider it more likely to confirm my present belief, that the whole of this section, comprising 15,700 acres, is suitable for oyster culture. If the soft bottom, 700 acres, is excluded, there still remains 15,000 acres, of which only some 230 are now productive or occupied.

#### SECTION XIV.

*Description:* Begins at the U. S. C. S. triangulation point known as "Cedar Island," in Lat.  $35^{\circ} 01' 56''.83$  N., and Long.  $76^{\circ} 21' 01''.13$  W., thence running N.  $24^{\circ} 14'$  E. (true)  $7\frac{7}{8}$  miles, more or less, to Brant Island Shoal Light House, in Lat.  $35^{\circ} 08' 10''$  N., and Long.  $76^{\circ} 17' 37''$  W., thence running N.  $80^{\circ} 12'$  E. (true)  $7\frac{1}{8}$  miles, more or less, to the Royal Shoal Light House, in Lat.  $35^{\circ} 09' 19''$  N., and Long.  $76^{\circ} 09' 30''$  W., thence running S.  $24^{\circ} 08'$  W. (true) 12 miles, more or less, to the U. S. C. S. triangulation point known as "Camp Point," in Lat.  $34^{\circ} 59' 51''.14$  N., and Long.  $76^{\circ} 14' 37''.2$  W., thence running along the northern shores of Hog and Cedar Islands to the beginning, containing, more or less, 39,988 acres.

This section is not a particularly important one, owing to the character of a large portion of its bottom.

*Depth of water:* This is uniform, and generally from 18 to 20 feet. The approaches to the Brant Island, and Royal Shoals and to Hog and Cedar Islands are bold, 15 feet being found within a quarter of a mile of shores and light houses.



*Character of bottom:* On all the central portions of the section soft, blue mud is the principal characteristic. Along the western and southern boundaries, in the southwestern portion of the section, and for 1 to  $1\frac{1}{2}$  miles off Hog and Cedar Islands, the bottom is of hard sand. The same characteristic predominates along the eastern boundary and for a considerable distance ( $2\frac{1}{2}$  to 3 miles) to the southward and westward of the Royal Shoal Light House. A tract of hard sand, about 2 miles long and 1 mile wide, extends to the southward and eastward from Brant Island Light House, and occupies the northwest corner of the section.

*Specific gravity:* This is rather low, but uniform, the average density being 1.0093; the maximum 1.0111, and the minimum 1.0080. The density increases as the Royal Shoal is approached.

There are no oysters or oyster beds in this section.

The current usually sets to the eastward, in the direction of Ocracoke Inlet and the entrance to Core Sound, with a velocity of from  $\frac{1}{4}$  to  $\frac{1}{2}$  knot per hour. The prevailing wind will, however, greatly influence both the direction and velocity. The cause of the set to the eastward is, doubtless, the flow from the Neuse River.

I regard that portion of this section lying in the center, and having a soft, muddy bottom, as unsuitable. The remaining area, comprising 17,000 acres, can be utilized and will produce a marketable oyster, though of rather inferior flavor, due to the low specific gravity of the water.

Attention is called to the remarks on Section XVII, and the inferences drawn from an experiment made in that locality. They are equally applicable to this area.

#### SECTION XV.

*Description:* Begins at Brant Island Shoal Light House, in Lat.  $35^{\circ} 08' 10''$  N., and Long.  $76^{\circ} 17' 37''$  W., thence running N.  $6^{\circ} 56'$  E. (true)  $12\frac{1}{8}$  miles, more or less, to the U. S. C. S. triangulation point known as "Swan Quarter," in Lat.

35° 18' 29''.67 N., and Long. 76° 16' 05''.23 W., thence running S. 73° 51' E. (true)  $6\frac{7}{8}$  miles, more or less, with a line drawn from the U. S. C. S. triangulation point known as "Judith," in Lat. 35° 21' 03''.21 N., and Long. 76° 24' 48''.19 W., through the aforesaid "Swan Quarter" triangulation point, to a point at the intersection of said line with a line drawn from the U. S. C. S. triangulation point known as "Bluff Point," in Lat. 35° 19' 30''.47 N., and Long. 76° 09' 26''.97 W., to the Royal Shoal Light House, in Lat. 35° 09' 19'' N., and Long. 76° 09' 30'' W., the said point of intersection being the corner of Sections XII, XIII and XVI, thence along said line from "Bluff Point" triangulation point S. 0° S. 52' W.  $8\frac{5}{8}$  miles, more or less, to said Royal Shoal Light House, thence S. 80° 12' W. (true)  $7\frac{7}{8}$  miles, more or less, to the beginning, containing, more or less, 45,413 acres.

This section lies in the middle of the Sound, between the Brant Island, Bluff and Royal Shoals, and directly in the line of the outflow from the Pamlico and Neuse Rivers. But for the low density of the water it would be a very important area. As it is, much of its ground is adapted to oyster culture.

*Depth of water:* Over the southern half the section, this is usually about 20 feet, but over the northern half the bottom is more irregular in contour, and the depth ranges from 5 and 6 to 20, with an average of about 16 feet. In the western central portion is a shoal extending  $2\frac{1}{2}$  miles to the western boundary and  $\frac{1}{3}$  mile wide, known as the "Middle Ground" or "Lower Middle;" it has but 5 to 11 feet over it and is surrounded by depths of 14 and 15 feet, which extend to the northward and southward of the shoal about a mile, and to the southward and eastward nearly 3 miles. Along the entire northern boundary, with the exception of a 15 foot slue, a mile wide in the middle, is a tract of a little over a mile in width, with from 8 to 11 feet over it; and in the extreme northwest corner is a portion of the 4 foot shoal making out to the southward and eastward of Great Island.

*Character of bottom:* In the deep water area, in the southern half of the section, the bottom is of soft mud with occasional

patches of hard sand or sand and mud mixed together. In the extreme southwest and southeast corners, near the Brant Island and Royal Shoals, the bottom is harder and of sand. On the "Middle Ground" and the 14 foot area, in its vicinity, already described, the bottom is hard, of sand and tenacious mud. Between this comparatively shoal area and the 8 to 11 foot tract lying along the northern boundary, is a deep slue or channel extending to within a mile of the western boundary, and over  $1\frac{3}{4}$  miles wide, in which the bottom is of soft mud. The tract along the northern boundary is of hard sand.

*Specific gravity:* This is uniform, but low. The average is 1.0095, the maximum 1.0100 and the minimum 1.0090. These figures show how important is the influence of the Pamlico and Neuse Rivers, as only 7 miles to the eastward, on the opposite side of the Bluff Shoal, the density on the same day was .005 greater. No oysters exist in the section.

The current is usually to the southward and eastward, in the direction of Ocracoke Inlet. The velocity and also the direction are considerably influenced by the winds, as in the other sections, but the set will seldom exceed  $\frac{1}{2}$  knot per hour.

It is possible to raise oysters on those portions of this section having the hard bottom. In the deep water and on soft bottoms, the ground is unsuitable. The low specific gravity of the water will prevent the stock, in all probability, from obtaining high or fancy prices, but a marketable oyster could be raised on the tracts indicated on the map. The area considered suitable is 13,390 acres, and comprises principally the Middle Ground Shoal and the adjacent hard bottoms, and the tract in the northern and northwestern part of the section.

#### SECTION XVI.

*Description:* Begins at the U. S. C. S. triangulation point known as "Bluff Point," in Lat.  $35^{\circ} 19' 30''.47$  N., and Long.  $76^{\circ} 09' 26''.97$  W., thence running S.  $0^{\circ} 52'$  W. (true)  $3\frac{1}{4}$  miles, more or less, with a line drawn from said "Bluff Point" triangulation point to the Royal Shoal Light House, in Lat.  $35^{\circ} 09'$

19'' N., and Long.  $76^{\circ} 09' 30''$  W., to the intersection of said line with a line drawn through the U. S. C. S. triangulation point known as "Swan Quarter," in Lat.  $35^{\circ} 18' 29''.67$  N., and Long.  $76^{\circ} 16' 05''.23$  W., and "Judith," in Lat.  $35^{\circ} 21' 03''.21$  N., and Long.  $76^{\circ} 24' 48''.19$  W., the said point of intersection being the corner of sections XII, XIII and XV, thence running along said line from "Judith" through "Swan Quarter" triangulation point, N.  $73^{\circ} 51'$  W. (true)  $15\frac{1}{2}$  miles, more or less, to said "Judith" triangulation point, thence running N.  $65^{\circ} 44'$  W. (true)  $5\frac{1}{8}$  miles, more or less, with a line drawn to the U. S. C. S. triangulation point known as "Willow Point," in Lat.  $35^{\circ} 22' 51''.6$  N., and Long.  $76^{\circ} 29' 41''.03$  W., to the intersection of said line with the shore of the mainland, thence running with the shore line of mainland to the beginning, containing, more or less, 38,315 acres.

This section is an important one, embracing a number of large bays and estuaries in Hyde county, in which oysters are more or less thickly distributed, and being well sheltered from the effect of gales. Unfortunately, such observations as have been made show a rather low specific gravity of the water; otherwise, this would be, probably, the most advantageous ground in the Sound. Lack of time has prevented more than a superficial examination of part of this area, and the determinations are therefore but approximate. The section is composed of so many different estuaries that for convenience and a clear understanding, each will be described separately.

*West Bluff Bay* is in the northeast corner of the section and comprises 1,126 acres. The depth of water is from 7 to 10 feet; a 2 foot shoal  $1\frac{1}{2}$  miles long and  $\frac{1}{4}$  mile broad lies off the point at the western entrance to the bay. The bottom is generally hard, of sand, with occasionally some little mud. The specific gravity has not yet been determined, but probably is 1.0080 or less. There is a small bay, comprising 260 acres lying, west of West Bluff Bay, which has similar characteristics, except that the depth of water is less, being from 3 to 6 feet. Small oyster beds lie along the shores of both bays.



*Juniper Bay*, and its tributaries, comprising an area of 1,710 acres, extends about 4 miles from a line drawn from Juniper Bay Point to the south point of the marsh opposite Swan Quarter Narrows. The depth of water is from 3 to 10 feet, and averages about 6 feet. The bottom is of hard sand along the shores for about one-third the width, and of soft mud in the middle third, in the channel. The specific gravity is 1.0079. The current sets out of the bay and under the influence of a strong northeasterly wind was  $\frac{1}{2}$  knot per hour. An oyster bed of considerable size lies on a 5 foot shoal off Juniper Bay Point and small beds and scattered groups are found along the northern and eastern shores further up the bay.

*Swan Quarter Narrows* is a strait about one mile long and a mile wide, which separates Great Island from the marsh to the northward. The depth of water is from 4 to 10 feet, the bottom hard, of sand, along the shores, and softer, of sand and some mud, in the deep water; and the specific gravity 1.0080. Oyster beds of considerable size are found off the northwest point of Great Island and about Bird Island, just to the westward of that point; and small beds and scattered oysters exist all along the northern side of the strait as far as Caffee Bay.

*Caffee Bay* is an arm of Swan Quarter Bay, making into the eastern shore of that body of water. It comprises 579 acres, with a depth of from 4 to 8 and 10 feet, and sandy bottom, except in the middle, where it is soft, of sand and mud. Small beds and scattered groups of oysters are found close in along the shores.

*Swan Quarter Bay*, with its tributaries, exclusive of Caffee Bay, comprises 4,076 acres. The depth is from 4 to 10 feet, the shoal water lying along the shores. The bottom is of soft or sticky mud in the middle of the bay, but is hard, of sand or mud or both, within  $\frac{1}{4}$  to  $\frac{1}{2}$  mile of the marshes. The specific gravity is 1.0103. Small beds and scattered groups of oysters are found along the eastern shores, from the northern entrance point of Caffee Bay to abreast Beacon B., opposite Swan Quarter. A few oysters are also found at the head of the Bay.

*Deep Cove* lies between Swan Quarter Island and Judith Island, and comprises an area of 1,325 acres. The depth of water is from 5 to 10 feet, and the bottom, except along the shores, is soft, consisting of mud, with small areas of sand and mud interspersed. No oysters are reported in this Cove, which appears to be admirably suited for them. Density observations have not yet been made. Deep Cove is connected by a narrow strait, known as Judith Narrows, lying between the island on which the "Judith" triangulation point is situated and Judith Island, with a bay of about the same area and characteristics, except the depth of water and extent of soft bottom, which is less. A number of oyster beds of considerable size lie in this bay, in the deep water and along the shores.

*Deep Bay* lies to the northward of Judith Island, and between it and Judith Marsh. It is an arm of Rose Bay, and comprises 3,591 acres. The depth of water is from 8 to 10 feet, except close to the shores, where it is from 3 to 5 feet. One large shoal, with about 2 feet of water over it, lies in the middle of the bay. The bottom is generally soft, except along the shores and on the shoal, where it is of hard sand and mud. No observations of the specific gravity have yet been made. Large areas, on which the oysters exist in groups and scattered singly, are found in the deep water of the bay, especially near its head, but they have not yet been definitely located.

*Bell's Bay* is also an arm of Rose Bay, but is on the western and opposite side from Deep Bay. It comprises an area of 1,814 acres, has an average depth of water of 10 feet, except within  $\frac{1}{8}$  to  $\frac{1}{4}$  mile of the shore, where the water shoals to 3 and 4 feet, and a soft bottom, except on the shoals, where it is hard. The specific gravity has not been determined. Small beds and scattered groups of oysters are found along the eastern shores.

*Germantown Bay*, an arm of Bell's Bay, is small, comprising but 166 acres, is generally shoal and has a soft bottom. A few small beds of scattered oysters are found in it.

*Rose Bay*, of which the bays just described are tributaries, is a large and important area of 4,415 acres. The depth of water

ranges from 7 to 18 feet, but is generally about 10 feet. The bottom on the greater part of the bay is soft, except within  $\frac{1}{4}$  mile of the shores, where it becomes sandy and hard. Off the northwest point of Judith Island, Swan Point and Fooley's Point, sand shoals, having from 2 to 4 feet of water over them, make out. No observations of the density of the water or strength of the currents have yet been obtained. Small beds and groups of oysters extend along the shores on both sides of the bay to above Watch Point, at its head.

The remainder of the section lying outside the areas just described is rather shoal, and the contour of the bottom irregular. Between Swan Quarter Island and Great Island the depth is from 7 to 10 feet; but a 14 foot slue,  $\frac{1}{2}$  mile wide, forming the channel into Swan Quarter Bay, passes through the middle of this tract. Except in this slue the bottom is hard, of sand with some little mud. The specific gravity is 1.0103 and the current  $\frac{1}{4}$  to  $\frac{1}{2}$  knot per hour, setting to the southward. Scattered oysters are reported to exist about the center of this tract and just to the eastward of the slue.

Between Great Island and the eastern boundary of the section is a large area ranging from 8 to 13 feet in depth. In the middle the bottom is soft, except directly in the center, where there is a large tract of about 1,000 acres, on which a hard, sandy bottom is found. Within  $1\frac{1}{2}$  miles of the various shores the bottom is also hard. Extending  $1\frac{1}{4}$  miles southeast from Great Island is a sand shoal (noted in Section XV) with about 2 feet of water on it. The specific gravity of the water on this area is from 1.0080 to 1.0090. The current sets to the southward and eastward at the rate of about  $\frac{1}{4}$  knot per hour. There are no oysters reported in the immediate vicinity.

When the detailed examination of this section is made and additional information regarding the currents, bottoms, oysters, and especially the density of the water, is obtained, the opinions now held as to the adaptability of the ground for oyster culture, may be modified. At present that opinion is favorable. Much of the bottom is soft, but the several tracts are small, and it is within

the limits of possibility to harden them. As far as the observations of the specific gravity of the water go, they are not particularly encouraging to the hope of raising a high grade of oyster. But the fact that the animals are now living even in the head waters of the various bays and tributaries, proves that the water is rarely, if ever, fresh enough to destroy them. Taking all things into consideration, I conclude that the whole of this section, of 38,315 acres, is suitable ground. Of this area the oyster beds occupy about 1,600 acres.

#### SECTION XVII.

*Description.*—Begins at the U. S. C. S. triangulation point known as "Brant Island," thence runs S.  $58^{\circ} 55'$  E. (true) 10 miles, more or less, to Brant Island Shoal Light House, in Lat.  $35^{\circ} 08' 10''$  N., and Long.  $76^{\circ} 17' 37''$  W., thence running S.  $24^{\circ} 14'$  W. (true)  $7\frac{1}{8}$  miles, more or less, to the U. S. C. S. triangulation point known as "Cedar Island," in Lat  $35^{\circ} 01' 56''.83$  N., and Long.  $76^{\circ} 21' 01''.13$  W., thence running N.  $45^{\circ} 01'$  W. (true)  $5\frac{3}{8}$  miles, more or less, to a point on the one fathom line of the shoal to the Northward of Swan Islands, thence running N.  $89^{\circ} 10'$  W. (true)  $2\frac{1}{2}$  miles, more or less, to a point at the intersection of this line N.  $89^{\circ} 10'$  W. (true) with a line drawn N.  $9^{\circ} 40'$  E. (true) to the aforesaid U. S. C. S. triangulation point on Brant Island, the said point of intersection being the corner of Sections XIX and XXI, thence running with said line N.  $9^{\circ} 40'$  E. (true)  $7\frac{1}{8}$  miles, more or less, to the beginning, containing, more or less, 38,888 acres.

This section lies between the Brant Island Shoal and Cedar Island Bay.

*Depth of water:* This ranges from 12 to 22 feet, the deeper water being found to the northward of the middle of the section, and thence shoaling gradually towards Cedar Island Bay and the Swan Islands, and more abruptly to the northward towards Brant Island Shoals.



*Character of bottom:* In the deep water the bottom is of soft mud. There is a tract about a mile broad at Brant Island, narrowing to  $\frac{1}{4}$  mile at Brant Island Light House and extending along the entire northern boundary, in which the bottom is hard, consisting of sand, with some mud where it borders on the deep water. A similar tract,  $2\frac{1}{4}$  miles wide, lies along the southern boundary, so that the soft bottom is confined to the deep water area from  $1\frac{1}{2}$  to 3 miles wide, extending through the northern central portion of the section.

*Specific gravity:* This is low, but uniform, varying only from 1.0080 to 1.0098. The average for the section is 1.0088. The current, which is merely the flow of the Neuse, accelerated or retarded by the action of the wind, sets to the southward and eastward. The velocity does not, under ordinary circumstances, much exceed  $\frac{1}{2}$  knot per hour. Additional observations on this point will be made as soon as circumstances permit.

Under my direction, two and a half years ago, fifteen bushels of oysters and one hundred and fifty bushels of clean shells were deposited in this section, at a point lying about one-third the way from the entrance to Cedar Island Bay to Brant Island Light House. The depth of water was about 18 feet, and the bottom sandy. Generally the characteristics and conditions were those peculiar to the whole hard bottom tract, lying along the southern boundaries of Sections XIV and XVII.

The plant was made, purposely, in an unfavorable position for the survival of the oysters. They were exposed to the full force of the freshets of the Neuse and the effect of the northeast gales. There was, in my opinion, every chance that they would perish, either by the action of fresh water, or by being smothered by sand stirred up by the gales. During the latter part of November, of this year, a search was made for this plant, and after considerable trouble, it was found. The experiment had been highly successful; the old shells were covered with good size oysters of over three inches in length. On one shell nine oysters were counted, and the average number to a shell was over five. These oysters were fat and in good condition, but somewhat too

fresh in flavor to command very high prices, if offered for sale. The implements at hand for taking oysters in such deep water were too rude to permit the obtainment of a large number; but our observations were sufficiently exact to justify the supposition that only a small number of the shells had been "sanded"—that is, covered by sand.

Considering that this plant was made where the conditions were all unfavorable, and where no oysters were to be found within several miles, it is assuming no more than the facts justify to say that what has been done in this place can be done elsewhere under similar circumstances in the Sound. In my own mind there never has been any doubt that a large portion of Pamlico Sound could be made to grow oysters, and the success of this experiment will, I hope, tend to convince others that this desirable result is within the limits of possibility.

With the exception of the artificial bed just described and a few groups about Brant Island, there are no oysters in the section. I am of the opinion that oysters can be cultivated successfully on the hard bottom tracts along the northern and southern boundaries of the section, but not in the middle, where the bottom is soft. Indeed, it is not a matter of opinion merely in this case, for the experiment has been made and has proved successful. The area of these two hard bottom tracts is 23,200 acres.

#### SECTION XVIII.

*Description:* Begins at the U. S. C. S. triangulation point known as "Judith," in Lat.  $35^{\circ} 21' 03''.21$  N., and Long.  $76^{\circ} 24' 48''.19$  W., thence running S.  $73^{\circ} 51'$  E. (true)  $8\frac{5}{8}$  miles, more or less, to the U. S. C. S. triangulation point known as "Swan Quarter," in Lat.  $35^{\circ} 18' 29''.67$  N., and Long.  $76^{\circ} 16' 05''.23$  W., thence running S.  $6^{\circ} 56'$  W., (true)  $12\frac{1}{8}$  miles, more or less, to Brant Island Shoal Light House, in Lat.  $35^{\circ} 08' 10''$  N., and Long.  $76^{\circ} 17' 37''$  W., thence running N.  $58^{\circ} 55'$  W. (true) 10 miles, more or less, to the U. S. C. S. triangulation point, known as "Brant Island," Long.  $76^{\circ} 26' 37''.6$  W.,

thence running N.  $9^{\circ} 19'$  E. (true)  $9\frac{3}{4}$  miles, more or less, to beginning, containing, more or less, 65,164 acres.

While this section is a very large one, it is of only possible importance, as it is exposed to the freshets from the Pamlico River. The section lies between the Brant Island Shoal, which forms the northern boundary of Section XVII, and the line of marshes on the southern shores of Hyde county.

*Depth of water:* The northern third of the section is comparatively shoal, the depth varying from 8 feet close to the marshes to 15 feet near the channel into the Pamlico River. The greater part of the remainder of the section is in deep water, of from 18 to 20 feet. Along the Brant Island Shoal, or the southern boundary, is a tract of from 1 to 2 miles wide on which the water is from 8 to 16 feet, the last depth being found close to the shoal. The 14 foot slue described under Section XVI as being the channel into Swan Quarter Bay occupies a considerable portion of the northeast corner of this section, and the Middle Ground Shoal, described under Section XV, also extends into Section XVIII for about 2 miles. It is one mile wide, has from 6 to 11 feet of water over it and lies in the extreme eastern part of the section.

*Character of bottom:* On the shoal tract lying along the southern boundary, as far out as the 16 foot curve, the bottom is hard, consisting of sand and occasionally sticky mud. The same characteristics prevail on the shoal tract, occupying the upper or northern third of the section. The slue forming the Swan Quarter Channel and several comparatively small areas in this region have soft, muddy bottoms; but generally it is hard, of sand or sand and mud, with frequently grass growing over it. The middle of the section, the channel way into the Pamlico River, is of soft mud.

*Specific gravity:* Only a few observations have been made, nor are many necessary, as there is nothing in the section itself to produce variations. The freshets in the Pamlico River probably have more effect than anything else, and an effort will be made in the spring to determine the extent of this influence.

From such observations as have been obtained the average density for the section is 1.0087.

*Oyster beds:* Several small beds lie about Brant Island and a few large ones along the marshes in the extreme northwest corner, near the triangulation point "Judith." A small bed is reported to be off Shell Point, on Swan Quarter Island, and other small beds lie close to the southern shore of Great Island. These beds have only been approximately located as yet and the areas and positions are therefore not exact. So far as known, they comprise an area of about 40 acres. The currents have not yet been determined.

From such information as is at hand, I am of the opinion that those bottoms which are hard are suitable for oyster culture and that the soft area, especially in the channel into the Pamlico River, is unsuitable. The area of hard bottom is 43,800 acres, upon which a fair marketable oyster could probably be grown. It is possible, however, that the water of this region is, at times, very fresh. Whether it ever becomes so much so as to be destructive remains to be proved; but considering the results of the experiment in Section XVII, and the fact that oysters live much higher up the river, I think it improbable that very much damage is often inflicted.

#### SECTION XIX.

*Description:* Begins at Pamlico Point Light House, in Lat.  $35^{\circ} 18' 50''.6$  N., and Long.  $76^{\circ} 29' 03''.55$  W., thence running N.  $57^{\circ} 39'$  E. (true)  $4\frac{3}{4}$  miles, more or less, to the U. S. C. S. triangulation point known as "Judith," in Lat.  $35^{\circ} 21' 03''.21$  N., and Long.  $76^{\circ} 24' 48''.19$  W., thence running S.  $9^{\circ} 19'$  W. (true)  $9\frac{3}{4}$  miles, more or less, to the U. S. C. S. triangulation point known as "Brant Island," in Lat.  $35^{\circ} 12' 35''$  N., and Long.  $76^{\circ} 26' 37''$  W., thence running S.  $9^{\circ} 40'$  W. (true)  $7\frac{7}{8}$  miles, more or less, to a point on the one fathom line of shoal to the north of Point of Marsh, the said point being the corner of Sections XVII and XXI, thence running N.  $46^{\circ} 00'$



W. (true)  $5\frac{1}{2}$  miles, more or less, to the U. S. C. S. triangulation point known as "Maw Point," in Lat.  $35^{\circ} 09' 06''.98$  N., and Long.  $76^{\circ} 32' 12''.93$  W., thence running along shore line of mainland to the beginning, containing, more or less, 50,639 acres.

This section lies along the eastern shore of Pamlico county and as it is made up principally of numerous bays, creeks and rivers, each will be described separately. Only a general and superficial examination of the region has, as yet, been made, and consequently the description can be but general in character and the various statements are subject to modification.

*Bay River* is a stream of considerable size, being about 11 miles long and from 1 to 2 miles wide and comprising with its tributaries, not especially mentioned, 8,690 acres. The depth of water is from 7 and 8 feet at the head, to 20 feet at the mouth. and water of from 13 to 20 feet will be found in the channel as far up as Windmill Point. Above that locality, the depth is from 7 to 10 feet. On both sides of the channel, along the shores, are tracts of shoal water about  $\frac{1}{4}$  to  $\frac{1}{2}$  mile broad, with a depth over them of from 1 to 3 feet. The bottom is generally soft or sticky, consisting of mud but on the shoals it is hard, Large shoals extend to the northward of Maw Point, and to the southward and eastward of Bay Point, the southern and northern entrances to the river. These shoals have from 2 to 5 feet of water over them with a hard, sandy bottom. The currents and specific gravity of the water have not yet been determined for this locality.

*Bonner's Bay* and *Spring Creek*, comprising 1,109 acres, are tributaries of Bay River. The depth is from 3 to 10 feet, except in the middle of Bonner's Bay where it increases to 15 feet. The bottom is soft, except on the shoals.

*Vandemere's Creek* is a narrow stream about 2 miles long, emptying into Bay River near Windmill Point. Including the bay at its mouth, it comprises an area of 1,168 acres. The depth is from 7 to 10 feet, and the bottom soft.

The oysters lie in small beds and groups along both shores of the Bay River for about 5 miles, or to just above Spencer's Creek. A few are also found off Petty's Point and on the south shore, opposite Vandemere's Creek. In Bonner's Bay are also several beds, lying to the eastward of the deep water. There are no oysters of any consequence in any of the other tributaries.

Bay River appears to be suitable for oyster culture, though the water is perhaps too fresh to produce stock of a high grade. It is also possible that subsequent observations will show the impracticability of doing anything with the soft bottoms in deep water and the ground of this character is only provisionally included in the available area.

*Jones Bay*, lying just to the northward of Bay River, is  $4\frac{1}{2}$  miles long,  $1\frac{1}{3}$  miles wide at its mouth and comprises 2,884 acres. A narrow channel, 12 to 15 feet deep, runs up the middle of the bay, on each side of which the water shoals gradually to the shores. Large shoals of several hundred acres area lie off the entrance points, especially the one to the northward near the Old Sow Island where the shallow water extends nearly  $1\frac{1}{2}$  miles to the southward and eastward. These shoals have from 3 to 5 feet of water, over hard bottom. In the bay the bottom is soft in the channel, hardening as the shores are approached. Neither density nor current observations have yet been made. The oysters lie along the northeastern shore to about  $\frac{1}{2}$  mile above Drum Creek, and on the southwestern shore from Maiden's Point up. The beds are all small and the oysters scattered. About Bay Point, the Fisherman's Islands and on the shoals already described as making out from Bay Point, several large, solid beds and many small groups of oysters exist, and on the shoal making out from "The Old Sow" and about that island numerous groups of oysters and solid beds are found. One especially large bed lies about the end of the shoal. It is probable that the whole of Jones Bay can be made productive, though it is possible that the difficulty of doing so, on the soft bottoms, will prevent their being utilized.

*Middle Bay* is a small estuary, lying next to the northward of Jones Bay. It comprises an area of 1,543 acres, and has a depth of 9 and 10 feet in the middle, which decreases to about 4 feet along the shores. The bottom is soft in the channel and hard inside the 6 foot curve. North of Middle Bay is a small cove called Big Porpoise Bay, comprising 785 acres. The bottom is generally hard and the depth from 3 to 8 feet. Between Porpoise Point, which is at the northern entrance to Big Porpoise Bay and Brant Island, the bottom is of hard sand and the water shoal, the depth ranging from 2 to 4 feet. A 15 foot slue, about  $\frac{1}{2}$  mile wide, extends N. N. W. from the Neuse River towards Middle Bay and forms the channel into that body of water. In this slue the bottom is soft.

Oyster beds lie on each side of the deep water in Middle Bay and, more or less, over Big Porpoise Bay. A line of beds and scattered oysters runs from the point of marsh between Middle and Big Porpoise Bays to Brant Island, and small beds are also found about that marsh, on every side. All the ground in Middle and Big Porpoise Bays, and over the shoals, is probably suitable ground for oyster culture.

Between Brant Island and the southern boundary of the section the water is from 15 to 25 feet deep and the area generally of soft bottom, though a considerable stretch of hard sand is found 3 miles to the northward and eastward of Maw Point and in the neighborhood of the shoal off the Old Sow. The density in this neighborhood is 1.0074. The currents have not yet been measured, but are of comparatively good velocity.

*Little Porpoise Bay* is a small cove of 149 acres lying immediately north of Porpoise Point. The depth of water is from 2 to 5 feet, and the bottom hard. A small oyster bed lies at the entrance to the bay.

*Mouse Harbor* is a bay lying immediately north of Little Porpoise Bay and south of Pamlico Light House. It comprises 1,490 acres, has a depth of from 4 to 8 feet, the deep water being found in the middle and the shoal water from  $\frac{1}{8}$  to  $\frac{1}{4}$  mile from the marsh. Oysters in groups and small beds are scat-

tered along the southern and western shores. This area appears well adapted to oyster culture, though subsequent investigation may prove the water to be too fresh.

The remainder of this section lies in a triangle formed by Pamlico Light House, "Judith," and Brant Island. A tract from  $1\frac{1}{4}$  to  $1\frac{3}{4}$  miles wide, lying along the line from Pamlico Point to Brant Island, has from 6 to 16 feet of water over it, the deep water lying furthest from the land. The bottom is hard, probably of sand. A small triangular area near Judith, and on the northern side of the Pamlico river channel, has a depth of from 10 to 16 feet, and hard bottom. The rest of the area is in deep water and has a soft, muddy bottom. There are no oysters or oyster beds anywhere on this ground.

While the want of the necessary observations as to the bottom and water prevents my giving an opinion at all decisive as to the adaptability of this section, yet as the oysters are growing in nearly every locality and some of them are of fine quality, there seems to be a possibility that all the area, with the exception of the deep water in the Pamlico and Neuse channels, may be utilized. This area amounts to 47,344 acres. If all the soft bottoms are excluded, as possibly they may subsequently be, the amount available would be 33,891 acres. Of this, about 1,000 acres will represent the area occupied at present by oysters, leaving 32,800 unoccupied and unproductive.

The copies of the licenses for "gardens," issued in Pamlico county, have not yet been received, but the entire area thus used does not exceed 150 acres. As soon as the work in Cedar Island Bay is completed, the survey of this section will be undertaken.

#### SECTION XX.

*Description:* Begins at the U. S. C. S. triangulation point known as "Willow Point," in Lat.  $35^{\circ} 22' 51''$  N., and Long.  $76^{\circ} 29' 41''$  W., thence running S.  $65^{\circ} 44'$  E. (true)  $5\frac{1}{8}$  miles, more or less, to the U. S. C. S. triangulation point known as "Judith," in Lat.  $35^{\circ} 21' 03''.21$  N., and Long.  $76^{\circ} 24' 48''.19$



W., thence running S.  $57^{\circ} 39'$  W. (true)  $4\frac{3}{4}$  miles, more or less, to Pamplico Point Light House, in Lat.  $35^{\circ} 18' 50''.65$  N., and Long.  $76^{\circ} 29' 03''.55$  W., thence running along the shore line of the Pamplico River and its tributaries, to the U. S. C. S. triangulation point known as "Hickory Point," in Lat.  $35^{\circ} 21' 44''$  N., and Long.  $76^{\circ} 41' 37''$  W., thence running N.  $16^{\circ} 12'$  E. (true)  $3\frac{7}{8}$  miles, more or less, to the U. S. C. S. triangulation point known as "Cousins Point," in Lat.  $35^{\circ} 24' 57''$  N., and Long.  $76^{\circ} 40' 25''$  W., thence running along the shore line of Pamplico and Pungo Rivers and their tributaries, to the beginning, containing, more or less, 63,437 acres.

This section has not been examined and nothing definite can be said with regard to it. Including, as it does, the Pamplico and Pungo Rivers with their numerous tributaries, it is probable that the water is too fresh to permit successful oyster culture. Upon that point, however, it is impossible to speak decisively until the specific gravity of the water has been determined. Providing that the indications in that respect are favorable, an area of 26,000 acres, which represents the hard bottom only, is suitable. It is probable, however, that only that portion of the section lying near the mouths of the Pamplico and Pungo will be found sufficiently salt, and the suitable area will consequently be much reduced.

#### SECTION XXI.

*Description:* Begins at the U. S. C. S. triangulation point known as "Point of Marsh," in Lat.  $35^{\circ} 04' 02''.47$  N., and Long.  $76^{\circ} 28' 29''.36$  W., thence running along shore line of the Neuse River, and its tributaries, to the U. S. C. S. triangulation point known as "Cedar Point," in Lat.  $34^{\circ} 58' 49''$  N., and Long.  $76^{\circ} 39' 33''$  W., thence running N.  $24^{\circ} 02'$  W. (true)  $3\frac{1}{4}$  miles, more or less, to the U. S. C. S. triangulation point known as "Whittaker's Point," in Lat.  $35^{\circ} 01' 23''.8$  N., and Long.  $76^{\circ} 40' 58''$  W., thence running along shore line of Neuse River and its tributaries, to the U. S. C. S. triangulation point known as "Maw Point," in Lat.  $35^{\circ} 09' 06''.98$  N., and Long.

76° 32' 12''.93 W., thence running S. 46° 00' E. (true)  $5\frac{1}{2}$  miles, more or less, to the intersection of said line S. 46° E. (true) with a line drawn from the U. S. C. S. triangulation point known as Brant Island, in Lat. 35° 12' 35'' N., and Long. 76° 26' 37'' W., S. 9° 40' W. (true), the said point of intersection being the corner of Sections XVII and XIX, thence running S. 15° 25' W. (true)  $1\frac{1}{4}$  miles, more or less, to the beginning, containing, more or less, 50,299 acres.

This section includes the area at the mouth of the Neuse River and that of the several tributary creeks and bays lying below Cedar Point and the Garbacon Shoal. As the suitable ground is principally located in these bays and creeks, they will be described separately. The section has only been superficially examined and the opinions held at present regarding it are subject to modification.

*Rattan Bay* lies opposite the Neuse River Light House at the mouth of the river, and comprises an area of 1,079 acres. The depth is from 2 to 8 feet, the deep water occupying the central part of the bay. On that area the bottom is soft, but as the water shoals it becomes hard. The specific gravity has not yet been determined, but in the river immediately opposite it is 1.0065. A few small oyster beds lie in the bay. The whole of this area appears to be suitable for oyster growing.

*Cedar Bay* is a small estuary, lying about 2 miles to the southward of Rattan and at the mouth of Turnagain Bay. It has a depth of from 2 to 7 feet, moderately soft bottom in the deep water and hard in the shoal, and appears to be good ground. Its area is 244 acres, and it contains no oysters.

*Turnagain Bay* is 5 miles S. S. E. of the Neuse River Light House and 4 miles S. S. W. of Point of Marsh. Its area is 2,391 acres. Abraham's Bay is a small tributary of Turnagain Bay, comprising 118 acres. The depth in Turnagain Bay is from 2 to 13 feet, the deep water forming a channel from  $\frac{1}{4}$  to  $\frac{1}{2}$  mile wide and extending up the middle of the bay and its branches. The 6 foot curve will be found from  $\frac{1}{4}$  to  $\frac{1}{2}$  mile off the shores on both sides. The bottom is soft in the deep water

and hard inside the 6 foot curve. In Pitman's Creek and Abraham's Bay, 4 to 8 feet will be found, with sticky and soft bottoms predominating. The density has not yet been determined. Small beds and scattered oysters lie off the mouth of Abraham's Bay and between that locality and Pitman's Creek on the west side, and opposite Hog Point on the east side of Turnagain Bay. The whole area appears to be favorably situated for oyster culture.

*South River* lies about 4 miles to the westward of Turnagain Bay and is an important tributary of the Neuse. It is about 7 miles long and from  $\frac{1}{8}$  mile at its head, to 1 mile wide at its mouth. Including its tributaries, its area is 2,922 acres. The depth of water is fairly uniform, ranging from 10 to 12 feet, except for about a mile from the mouth, where it increases to 15 and 20 feet, forming a deep channel out of the river and into the Neuse. Close along the shore the water is shoal and the bottom hard, but on the major portion of the area soft or sticky bottoms will be found. A few small oyster beds and scattered oysters lie near the mouth of the river, on the shoals on each side of the deep channel. The whole area appears adapted to oyster culture. In neither Turnagain Bay nor South River has the density been yet determined; and as the water outside these estuaries is of a low specific gravity it is possible that both bay and river may be found unsuitable when they are more thoroughly and systematically examined. The presence of living oysters in these waters has, however, caused them to be provisionally included in the available area.

Off the southern and western shores of the Neuse, from Point of Marsh to the Garbacon Shoal, there is a stretch of hard bottom, from  $1\frac{1}{2}$  to 2 miles wide, with from 6 to 20 feet of water over it. Indeed, the 20 foot curve marks quite accurately the outer limit of this tract. Off the Point of Marsh an extensive shoal, with from 5 to 10 feet over it, makes out  $1\frac{1}{2}$  miles to the northward and westward, and just to the eastward of South River is a similar shallow area extending off shore a little less than a mile. Off Sandy Point, near the southern and western limit of the section, a 6 foot shoal makes out for a mile,

and off Cedar Point is the well known Garbacon Shoal, with from 6 to 10 feet of water, and extending to the middle of the channel. On the northern and western shores, the 12 foot curve lies a little less than a mile from the land and inside of it the bottom is hard. About 1 mile to the southward and westward of the mouth of Broad Creek, the Gum Thicket Shoal, having from 2 to 5 feet over it, makes out a mile to the eastward, and off Piney and Maw Points are large shoals with but from 1 to 5 feet over them and extending  $1\frac{1}{2}$  miles from the land. The Neuse River Light House is situated on the extremity of the first of these two shoals.

Between the tracts of hard bottom adjacent to the shores the Neuse is 20 to 22 feet deep, with a soft, muddy bottom. In this region, and on the shoals already described, where the depth is less than 3 feet, successful cultivation of oysters can hardly be achieved. But the remaining hard bottoms form good ground.

*Broad Creek* is the only tributary on the northern and western side of the Neuse that is of sufficient importance to justify especial mention. With its tributaries, it comprises 1,068 acres. The depth ranges from 6 to 10 feet and the bottom, except along the shores, is soft. The creek has numerous small streams flowing into it and it is probable that the water is too fresh to produce a very high grade of oysters. Small beds and scattered groups lie about the mouth and in the lower part of the creek. Density and current observations have not yet been made. Immediately north of Piney Point and Broad Creek, is a shallow estuary, known as Swan Creek. It comprises 173 acres, has a depth of from 2 to 4 feet, and soft bottom.

The ground may be considered suitable in both Broad and Swan creeks, wherever the bottom is sufficiently hard, to support the oysters. But, as with the bays and river on the southern shore, the density of the water exercises the most important influence; and until that has been determined nothing definite can be stated. In the Neuse itself the average specific gravity is 1.0057, which is sufficiently low to throw grave doubts upon the feasibility of doing anything with the area. As, however,



oysters are growing now in the section, those localities having suitable bottom are provisionally included in the available area. Excluding the ground now occupied by oyster beds, which is, approximately, 230 acres, there is 28,600 acres of possible value.

#### SECTION XXII.

*Description:* Begins at the U. S. C. S. triangulation point known as "Point of Marsh," in Lat.  $35^{\circ} 04' 02''.47$  N., and Long.  $76^{\circ} 28' 29''.36$  W., thence running N.  $15^{\circ} 25'$  E. (true)  $1\frac{1}{4}$  miles, more or less, to a point on the one fathom curve of the shoal to the northward of said Point of Marsh, the said point being the corner of Sections XVII, XIX, and XXI, thence running S.  $89^{\circ} 10'$  E. (true)  $2\frac{1}{2}$  miles, more or less, thence S.  $45^{\circ} 01'$  E. (true)  $5\frac{5}{8}$  miles, more or less, to the U. S. C. S. triangulation point known as "Cedar Island," in Lat.  $35^{\circ} 01' 56''.83$  N., and Long.  $76^{\circ} 21' 01''.13$  W., thence running along the shore line of Cedar Island and of the several bays shown on the charts of the U. S. Coast and Geodetic Survey as North, Cedar Island, and Long Bays, and crossing in a due south direction the stream known as the "Thoroughfare," at the head of Thoroughfare Bay, at a point in Lat.  $34^{\circ} 55' 39''.7$  N., and Long.  $76^{\circ} 22' 00''$  W., to the beginning, containing, more or less, 28,615 acres.

This section is now under examination, and promises to develop very favorable indications.

*Depth of water:* The contour of the bottom is irregular and the changes in depth very abrupt. In the middle of Cedar Island Bay is a somewhat tortuous channel, 5 miles long and  $\frac{3}{4}$  mile broad, in which the depth is from 15 to 20 feet. Narrow branches of this channel, with depths ranging from 10 to 17 feet, extend into the several tributary bays. From the Point of Marsh a 2 to 3 foot shoal,  $\frac{1}{2}$  mile broad, follows the boundary lines of the section closely as far as the Swan Islands, and then extends to the southward  $1\frac{1}{2}$  miles, to the edge of the deep channel in the bay. Between this shoal and the marsh forming the mainland, is a tract about  $4\frac{1}{2}$  miles long and 1 mile wide, over which the depth is uniform, being from 7 to 9 feet. West of this area,

the water shoals gradually to the marsh, from  $\frac{1}{4}$  to  $\frac{1}{2}$  mile distant; and similar shoal water is found about Raccoon Key, which lies between the Swan Islands and the mainland. East of the shoal extending south from the Swan Islands, and as far as the boundary line of the section, the depth is from 7 to 13 feet, the deep water being to the eastward.

There is a long, tongue-shaped, 2 foot shoal extending about S. E. 2 miles from the marsh, at a point 2 miles south of Raccoon Key; but with this exception the shoal water of less than 3 feet, along the western shore, lies close to the marsh as far as the head of Long Bay. In the same way, along the southern and eastern shores, there is a depth of 3 feet or more close to the marsh but both the 6 and 12 foot curves are from  $\frac{1}{5}$  to  $\frac{1}{2}$  mile and from  $\frac{1}{3}$  to 1 mile respectively, distant from the land. Generally the depth in Cedar Island and Long Bays is from 4 to 9 feet, except in the deep channels in the middle of the bay and its tributaries; and, except in Cedar Island Bay, these channels are narrow and occupy but comparatively little space. In North Bay the water is shoal, ranging from 1 to 7 feet; and west of the island on which the triangulation point "Cedar Island" is situated, is a shoal about one mile in diameter, which rises abruptly to 1 and 4 feet from the deep 20 foot channel forming the entrance to the bay.

*Character of bottom:* In the deep water and channels it is soft, consisting of mud. On the shoals it is of hard sand, and in the moderately deep water, that between 12 and 6 feet, the bottom is also hard, consisting of sand or sand and mud mixed, with spaces and slues of soft mud interspersed over the area.

*Specific gravity:* Complete observations have not yet been made, but so far an average of 1.0082 is indicated for the main portion of Cedar Island Bay.

*Oyster beds:* These are numerous, and many are of good size. Only approximate positions and areas can be given as yet, as the survey is not completed.

Scattered groups and small beds lie in North Bay, on the shoals on each side of the channel in Cedar Island Bay and along the

western and northern line of shoals in Long Bay. About the Swan Islands, Point of Marsh and Raccoon Key, beds and groups are plentiful; the whole tract, lying between the shoal off the Point of Marsh and the shore being, in fact, an almost continuous oyster bed. Here a very large growth of young oysters has been noticed and only a few empty or dead shells discovered. The approximate area occupied by oysters in the section is 1,070 acres. Little or no current has been observed so far in the bay; subsequent observations, however, may show different results in other portions of the area.

Cedar Island Bay and its tributaries, which compose this section, I regard as excellent ground for oyster culture. The waters are well protected by marshes and shoals from the deleterious effects of gales and freshets; a large proportion of the bottom is suitable in character, and those areas now too soft can probably be made sufficiently hard without great expense, and finally, there are already numerous prolific beds scattered about the shoals and shores. There is, however, a lack of current, which is a drawback, and in addition the specific gravity is too low to permit the production of a uniformly high grade of stock. When all the data have been obtained, however, an improvement in this respect may become evident. As it appears at present, there is no insuperable difficulty in making the entire 28,600 acres productive, and even when the soft bottoms in the channels, amounting to 5,000 acres, which are of rather a possible than a probable value, are excluded, there remains 23,800 acres which can, in all likelihood, be turned into oyster beds.

#### SECTION XXIII.

*Description:* Begins at the U. S. C. S. triangulation point known as "Camp Point," in Lat.  $34^{\circ} 59' 51''.1$  N., and Long.  $76^{\circ} 14' 37''.2$  W., thence running S.  $78^{\circ} 58'$  E. (true)  $5\frac{1}{8}$  miles, more or less, with a line drawn to the U. S. C. S. triangulation point known as "Wade," in Lat.  $34^{\circ} 58' 58''.93$  N. and Long.  $76^{\circ} 09' 11''.2$  W. to a point at the intersection of said line with the shore of Core Banks, thence with the western shore line of Core Banks to a point at the intersection of said shore

line with the prolongation of a line drawn from the U. S. C. S. triangulation point known as "Davis Shore," in Lat.  $34^{\circ} 46' 51''.6$  N., and Long.  $76^{\circ} 27' 53''.3$  W., to the U. S. C. S. triangulation point known as "Shingle Point," in Lat.  $34^{\circ} 45' 18''.8$  N., and Long.  $76^{\circ} 26' 18''.6$  W., thence with said line to the triangulation point "Shingle Point," thence to the triangulation point "Davis Shore," thence along the shore line of the mainland and across in a due north direction, the stream known as the "Thoroughfare," at the head of Thoroughfare Bay, at a point in Lat.  $34^{\circ} 55' 38''.1$  N., and Long.  $76^{\circ} 22' 00''$  W., thence to the eastward along the shore of Cedar Island to its intersection with the southern boundary line of Section XIV, thence to the eastward with said boundary line of Section XIV to the beginning, containing, more or less, 44,307 acres.

This section is one of the most important in the State, embracing as it does the northern portion of Core Sound and its tributaries. As the latter are large, and as the depth of water and character of bottom varies considerably, each tributary will be especially described.

. *Back Bay* is surrounded by Hog Island and its connecting marshes, and comprises an area of 882 acres. The depth of water is from 1 to 7 feet, the bottom of hard mud or sand, covered, more or less, with grass, with numerous small areas of soft mud. The specific gravity of the water is 1.0107. There are a few small oyster beds and small scattered oysters in the bay, and in the opening in the marsh at Camp Point, where the bay is connected with the Sound, and at both ends of Oyster Creek (another connection through the southern shore of Hog Island) several artificial beds are located.

Back Bay has all the conditions necessary to successful oyster culture, except depth and clear bottom. If the grass is cleared off, however, there will be no difficulty in utilizing that portion of the area lying in more than 2 feet of water, and even the very shoal ground of this well protected locality can be made of use, should the elaborate French systems of cultivation ever come in vogue. About 400 acres is, then, of probable and 880 of possible value.



*Hog Island Bay* lies immediately to the southward of Back Bay, between Hog Island and Cedar Island, and comprises an area of 2,140 acres. The depth of water is from 7 to 9 feet over the central portion, and from 2 to 3 feet over the surrounding tracts and along the shores. The bottom is moderately soft in the middle of the bay, consisting of sand, more or less consistent, interspersed with small mud patches, and of hard sand along the shores and in the shoaler water. About the head of the bay the water is very shoal, with hard, sandy bottom; and here as elsewhere on sand bottoms in this vicinity a large quantity of grass will be found growing. The specific gravity of the water is 1.0109. No natural oyster beds exist in the bay, but small scattered groups are occasionally encountered; several oyster "gardens" (artificial beds) have been established along the northern, Hog Island shores.

Hog Island Bay is well adapted for cultivation, being sheltered, of fair depth, generally good bottom and sufficiently high specific gravity. In the very shoal waters there will be some danger from extremes of heat and cold; but in the deep water no serious drawback exists.

Next to the southward of Hog Island Bay is Lewis Creek, a small tributary of Core Sound, comprising 41 acres in very shoal water. It is of no practical importance.

*Rumley Bay* lies between Hog Island Bay and Thoroughfare Bay and comprises 211 acres. The depth of water is from 2 to 5 feet, the bottom of hard sand and the density of the water 1.0117. Numerous small oyster beds are scattered about this bay, which will prevent its utilization for artificial beds, otherwise the whole area is well adapted for that purpose.

*Thoroughfare Bay* is a large estuary lying between Cedar Island and Hunting Quarters and comprising an area of 2,773 acres. At its head it is connected by a narrow creek or canal known as the "Thoroughfare," with Cedar Island Bay. In the lower or eastern part of the bay the depth of water is from 6 to 8 feet except for about  $\frac{1}{4}$  mile along the northern and southern shores, where it is from 1 to 3 feet. Deeper water is found along Cedar

Island than on the opposite side of the bay. In the upper portion the depth is from 2 to 5 feet, the least water being along the shores and at the head of the bay near the entrance to the Thoroughfare. In this region the bottom is of mud, both soft and hard, the areas being small and interspersed. As the central and lower portions are approached, soft mud predominates. Below Berry's Bay, which is at about the middle of Thoroughfare Bay, the bottom is nearly all soft mud except where oysters are encountered and on the shoal tract lying between Hall's Point and the mouth of Berry's Bay, along the southern shore of Thoroughfare Bay. On this latter area the bottom is of hard sand.

The specific gravity in the upper part of the bay is 1.0124; in the middle and in Berry's Bay 1.0120, and in the lower portion and at the mouth 1.0124. There are a few scattered oysters in the upper part of the bay, a large number in the Thoroughfare, and in the lower and lower central portions both large beds and numerous areas of scattered oysters.

While the bottom in this locality is in many places rather soft, it is not so much so as to preclude improvement, and as the other conditions are so favorable, the whole of the ground is included in the area which is deemed suitable for cultivation. The extent of the natural beds, which is considerable, will, however, reduce somewhat the area available.

*Styran's Bay*, comprising 489 acres, is merely an indentation in the shore between Steep and Mill Points. The depth is from 3 to 7 feet; but only 1 and 2 feet will be found in the cove immediately to the northward of Mill Point and between that point and Cedar Creek. Generally the 3-foot curve lies about  $\frac{1}{8}$  mile off shore. The bottom on this shoal ground is of hard sand covered more or less with grass. As the water deepens the bottom becomes softer, changing first to soft sand and then to soft mud, and the amount of grass diminishes. The density of the water is 1.0126. No beds, and only a few scattered oysters were found in this bay, but several artificial beds have been established along the northern shores and in the neighborhood of Steep

Point. The whole area appears to be both suitable and available for oyster culture.

*Nelson's Bay*, comprising 914 acres, is a large and important area lying between Mill and Piney Points. It is about 2 miles long and from  $\frac{1}{2}$  to  $\frac{3}{4}$  mile wide. Several small creeks whose area is included in that of the bay empty into it from the western shore. The depth of water in the bay is from 2 to 8 feet. In the upper and northern half 4 to 5 feet are found except along the shores, where the water is shoal. The bottom in this region is principally of soft sand, with some soft mud. Along the shores and on the shoal ground the bottom is harder. Through the middle and towards Salter's Creek, soft mud will be found. The specific gravity is 1.0130. About the middle of the bay the depth is from 3 to 4 feet with a narrow channel of 8 feet, less than  $\frac{1}{4}$  mile wide, in the middle. In this channel the bottom is of soft mud; on the shoals on each side, of soft sand which grows hard as the shore is approached. Off Drum Point, on the northern and eastern side, a long sand shoal with from 1 to 3 feet over it makes out to the channel, and here the specific gravity is 1.0142. The lower part of the bay is in from 4 to 9 feet of water except within about  $\frac{1}{8}$  to  $\frac{1}{4}$  mile of the shore, where only 1 and 2 feet will be found. The bottom is soft sand with occasional small areas of mud; along the shores, as is usual, hard sand is the principal characteristic. The specific gravity in this region is 1.0132. The oyster beds lie in the central and upper portions, and are somewhat indiscriminately scattered over the whole area. The larger beds are found in the middle part, on the edges of the deep water. In the lower portion of the bay are a few small beds, scarcely large enough to deserve the name, and a few scattered oysters.

In Huff's Creek (28 acres), the most southerly tributary, the average depth is 3 feet, and the bottom of hard sand along the southern shore, soft mud in the middle and soft sand on the northern shore. The upper end of the creek is of soft mud. One oyster garden is located on the southern side.

In Willis Creek (19 acres), which is opposite Drum Point, the depth is from 2 to 3 feet, and the bottom principally of soft sand and grass, except in the middle of the creek, where it is of soft mud. An oyster bed of considerable size lies at the mouth of the creek and an oyster garden is located in the N. W. branch. In Lewis Creek the depth is from 1 to 3 feet and the bottom similar to that in Willis Creek. There are no natural beds, but an oyster garden is located on the northern side near the mouth of the creek. In Broad Creek, which lies in the upper part of the Bay, the depth is about 3 feet, and the bottom of soft sand and soft mud. Numerous groups of oysters and small beds are scattered over the area. In Salter's Creek, at the head of the bay, the depth is 3 feet and the bottom soft mud. A large portion of the area is taken up by "gardens." There are a number of gardens along the eastern shores of Nelson's Bay, above Drum Point; but only those having licenses of record are shown on the map.

The whole of Nelson's Bay and its several tributaries appears well adapted to oyster culture, though the very soft bottoms will require treatment before they can be used with great success. It is possible also that the sandy bottoms may move under the influence of heavy gales; but a liberal deposit of shells would soon remedy that defect. Grass, wherever growing, would have to be eradicated to a great extent. The number of natural beds in the bay is a drawback, as they are so numerous that a considerable part of the total area is through them excluded from improvement. The limits of these public grounds have been defined and as soon as laid down on the large scale maps, they can be accurately described. Excluding them, the bay can be made an excellent oyster ground.

*Brett's Bay* makes into the land immediately to the southward and westward of Piney Point, between which and King's Point the bay is situated. Its area is 281 acres. The depth is from 1 to 5 feet, the bottom soft sand or soft mud, except close to the shores where the sand becomes hard, and the specific gravity is from 1.0120 to 1.0086. Numerous small beds and groups of scattered oysters lie about the marshy islets off Piney Point,



and also from the western shore well out into the middle of the bay. The area is well adapted for oyster culture, but the numbers of small beds or groups of oysters growing naturally, absorb a considerable portion of the area.

*Oyster Creek* lies next to the southward of Brett's Bay and comprises an area of 136 acres. It is a long and narrow stream with a depth of from 1 to 3 feet, and soft or sticky bottom, except along the shores and in shoal water, especially at the entrance, where the bottom becomes firmer, though the muddy characteristic still predominates. No oysters were found in this creek, but if the bottom is made consistent they will grow there without difficulty.

*Great Island Bay*, comprising 630 acres, lies on the eastern or "Banks" side of the Sound near the southern boundary of the section. The water is generally shoal, the depth ranging from  $\frac{1}{2}$  foot to 2 and 3 feet, the principal portion of the area being taken up by the shoal ground. The deep water forms a narrow channel in the middle of the bay and in it is the only ground of any importance. Here the bottom is soft or sticky, but on the shoals it is of hard sand.

In Great Island Bay and in all the other indentations in the marshes along the "Banks," are narrow slues and channels with soft bottoms, in which the oysters flourish and from which a superior quality of stock is produced. But the entire area comprised in these slues is small; their accurate determination would require a new survey of the greater portion of the Sound, and their particular description would increase the limits of this report beyond reasonable bounds. They are therefore neglected in these remarks.

The remainder of the section comprises the whole northern part of Core Sound.

*Depth of water:* The contour of the bottom is irregular, the depth ranging from 1 to 9 and 10 feet. Generally the deep water will be found midway between the two shores; but abreast Piney Point the channel approaches the western shore, while off Mill Point it is nearer the Banks. From Steep Point to the

northward it is nearly in the middle. For the whole length of the Sound considerably deeper water is found along the western shores than off the Banks, and as the northern boundary of the section is approached the area of comparatively deep water is much expanded. From the Banks, the shoals extend about one mile into the Sound except opposite Steep and Mill Points, where the width of the shallow water is only  $\frac{1}{4}$  to  $\frac{1}{2}$  mile. Over these shoals the depth is generally less than 1 foot, except in the narrow and tortuous slues leading in to the marshes, and to which reference has already been made. Along the western shores the 3 foot curve lies generally within less than  $\frac{1}{4}$  mile of the land. Between these two shoal tracts the depth is from 6 to 8 feet, except off Piney Point, where it decreases to 3 and 4 feet.

*Character of bottom:* From "Davis Shore," at the southern boundary of the section, to Mill Point, the bottom on the shoals is of hard sand; in the middle, generally of soft sand, and over both areas is more or less grass. From Mill Point to Hall's Point the bottom is hard sand on the shoals and near the western shores, and of hard mud in the middle and channel. A few areas of soft sand are found in the deep water off Hall's Point, and occasionally small tracts of soft mud will be encountered. In the shallow water on sandy bottom there is considerable grass. From Hall's Point to Long Point hard sand is found near the shores and mud in the channels. Off the mouth of Thoroughfare and Rumley's Bays hard mud and sand continue across the Sound, the sand predominating near the Banks. Off the mouth of Lewis Creek the bottom is of soft sand and grass, the former becoming harder as the distance from the shore increases. Off Robinson's Point it is of hard sand until the channel is reached, where it is of hard or soft mud. Along the Banks the usual sand and grass is found. Off Hog Island, except along the shores, is a large area of soft mud, with sand and grass near the shoals; and from Hog Island to the boundary of the section sand and grass is the predominating characteristic, though mud is found in the narrow channel leading into the Sound.

*Specific gravity:* The average for the section is 1.0122, but the density varies from 1.0100 at the northern boundary to 1.0200 at the southern.

*Oyster beds:* In the southern portion of the Sound there are no natural beds until the region about Piney Point and off the mouth of Nelson's Bay is reached. A number of "gardens," however, have been located off Davis Shore. Between Drum Point and Cedar Inlet many small groups of oysters exist; but they are so small as to hardly merit mention. They lie at intervals nearly across the Sound from the western to the eastern shore. Between Steep and Hall's Points are a number of large beds, though only in a few instances are they solid rocks. They lie in the deep water or channel way. Off the mouth of Thoroughfare Bay no oysters of any consequence were found; but between Rumley's Bay and the northern boundary of the section the beds become numerous and comparatively of good size. They are especially thick off Robinson's Point and to the southward of Harbor and Wainwright Islands. Very few beds lying in the Sound are what the oystermen term "rocks;" but most of the areas indicated on the map as beds have been subject to a more or less continuous fishery, and though the oysters are now rather scarce and scattered, the ground which they occupy has been considered as properly "public" and therefore included in the area so denominated. The artificial beds or "oyster gardens," not already described, are located in the slues through the shoals off the Banks. Several lie opposite to Styran's Bay and Mill Point and others opposite Thoroughfare Bay; but the majority have been located opposite Hog and Harbor Islands and near the northern limit of the section. The positions of the several public and private grounds can be best understood by reference to the accompanying map; but as the scale of that map is very small ( $\frac{1}{40000}$  of the actual size) all the areas are exaggerated somewhat. The actual area, position and limits of each public and private bed is being determined as fast as possible or as the work can be laid down on the large scale maps.

No enemies of the oyster were discovered; but the ribbed mussel (*Meodiola plicatula*) appeared to be abundant. The oysters were generally of a fair quality, and those coming from the deep water, either in the Sound or its tributaries, where they exist in scattered groups, were especially fine.

I consider this section, with the exception of the shoal water along the eastern or Banks shores, as excellently adapted for oyster culture.

The currents are on an average above  $\frac{1}{2}$  knot per hour though their velocity is greatly influenced by the wind. The bottom is generally hard or sufficiently so to support the oysters, and the specific gravity is comparatively high. The drawbacks are the amount of grass which grows on the shoals and which is torn up by gales and piled along the shore and on the bottoms, and the numbers of small groups of natural growth oysters that are scattered about the area. Until these latter are located and defined by legal enactment, any material advance in the oyster industry in this region is hopeless; as otherwise no man can know whether he has included a natural bed within his boundaries or not. These natural beds comprise an area of 763 acres. Excluding them and the unsuitable ground, 32,000 acres remain, which are suitable for cultivation and on a large proportion of which an excellent oyster can be raised:

#### SECTION XXIV.

*Description.* Begins at the U. S. C. S. triangulation point known as "Davis Shore," in Lat.  $34^{\circ} 46' 51''.6$  N., and Long.  $76^{\circ} 27' 55''.3$  W., thence running to the westward with the shore of the mainland, around Jarrett's Bay, North River and Newport River and crossing Harlow Creek at its head, at the entrance to the Clubfoot Canal, to the eastern end of the railroad wharf at Morehead City, the same being in Lat.  $34^{\circ} 43' 05''$  N., and Long.  $76^{\circ} 41' 21''$  W., thence S.  $29^{\circ} 37'$  E. (true)  $1\frac{1}{2}$  miles, more or less, with a line drawn from said end of the railroad wharf to the U. S. C. S. triangulation point known as "Fort Macon," in Lat.  $34^{\circ} 41' 41''.6$  N., and Long.  $76^{\circ} 40'$



23''.3 W., to the intersection of said line with the shore line of Bogue Banks, thence to the southward and eastward with said shore line to a point at its intersection with a line drawn S.  $48^{\circ} 02'$  E. (true) from the said "Fort Macon" triangulation point, thence with said line S.  $48^{\circ} 02'$  E. (true) 1 mile, more or less, to its intersection with the shore line of Shackleford Banks, thence the north shore line, to the northward and eastward, following with said shore of Shackleford Banks and the west shore of Core Banks to a point at the intersection of said shore line, with a line drawn S.  $49^{\circ} 41'$  E. (true) from the U. S. C. S. triangulation point known as "Davis Shore" through the U. S. C. S. triangulation point known as "Shingle Point," in Lat.  $34^{\circ} 45'' 18''.8$  N., and Long.  $76^{\circ} 26' 18''.6$  W., thence with said line, N.  $49^{\circ} 41'$  W. (true) through the "Shingle Point" triangulation point, to the beginning, containing more or less, 39,137 acres.

This section includes the southern portion of Core Sound and those important tributaries, Jarrett's Bay and the North and Newport Rivers. For the reasons given under Section XXIII, the principal tributaries will be separately described.

*Spit Bay* is a small, shallow estuary lying about a mile to the southward of the Davis Shore triangulation point and immediately to the northward of Davis Island. Its area is 59 acres, the depth from 1 to 2 feet, and the bottom of sticky mud and grass. As it is sheltered, it can be utilized for oyster culture, though its want of depth will cause operations to be somewhat hazardous.

*Jarrett's Bay* is a large and important arm of Core Sound, comprising 2,295 acres. The depth of water is from 2 to 6 feet, and 3 feet can be found over the principal part of the bay; the very shoal water lying close to the shores. Four large creeks, known as Willis, Wade, Jumping Run and Hancock's Creeks, empty into the bay from the westward and Broad Creek at the head. In Broad Creek the depth is from 1 to 3 feet, the bottom of soft mud, except along the eastern edges, where it is of hard sand. Scattered oysters are found over the area.

Willis Creek has from 2 to 3 feet of water and soft bottom, generally mud overlying a shelly stratum. Wade Creek is of the same general character, but the depth of water is only from  $\frac{1}{2}$  foot to 2 feet. Jumping Run Creek is deeper, having from 1 to  $3\frac{1}{2}$  feet, and Hancock's Creeek from 1 to  $2\frac{1}{2}$  feet. In all the creeks the bottom is soft. In Hancock's and Jumping Run Creeks small oyster beds lie along the southern shores, and in all the creeks there are many groups or small beds of scattered oysters, partly or wholly covered with mud, interspersed over the bottoms. These creeks are all favorable places for planting, but the bottom must be rendered firm before much success will attend efforts in oyster culture.

In the bay the bottom is generally of mud, except along the shores, especially the eastern, where it is of hard sand, which becomes soft as the water deepens. The upper portion of the bay is covered with scattered oysters and solid beds or "rocks," surrounded by mud. The density is high, ranging above 1.0200. About the head of the bay and creeks it is on occasions considerably lower, but the average will be between 1.0100 and 1.0200. The currents are sluggish, with a general but slow set towards the mouth of the bay. The oyster gardens, as shown on the map, lie along the western side of the bay and in the creeks before mentioned. Numbers of these gardens have been staked out, and some have been improved, but many of the owners have no license, and as this survey has not taken cognisance of lots of that description, they are not shown on the maps. The positions of most of them, however, have been ascertained, and the lots can be established if the licenses are obtained.

Jarrett's Bay has a good reputation among oyster consumers, and the oysters found there are, at times, of a superior quality. It is well suited for "planting" purposes, that is, the improvement of stock, but is not well adapted to raising the same. The bottom is too soft generally for any use, but it can be improved at comparatively little cost, and once made sufficiently hard, oysters thereon would probably attain a fine flavor and command good prices.

*Lewis Creek* lies immediately south of Bell's Point. It is small, comprising about 69 acres, and shallow, having but 1 or 2 feet of water. The bottom is of soft mud, except about the edges, where it is of sand or sand and mud. Oysters are more or less thinly scattered over the area. The ground is considered as favorable, but the want of depth is a drawback.

*Sleepy Creek* lies at the eastern entrance to the Straits, and comprises an area of 99 acres. The depth is about 2 feet and the bottom sticky, hardening towards the land. Small oyster beds, dry at low water, lie along the shores, and nearly the whole creek has been taken up by oyster gardens; very few owners, however, have secured licenses, though in some cases applications are pending. The density does not exceed that of the Straits, which is 1.0270 at this point, and during wet weather is considerably less.

*Eastmouth Bay*, comprises 250 acres and forms an indentation in the eastern shore of Harker's Island. There is a narrow channel making up the middle of the bay in which the depth is from 2 to 4 feet. On each side of this channel the water is shoal. The bottom is of mud, more or less soft, with a good deal of grass growing on it, especially in the middle portions. The density is, on an average, above 1.0200. Oysters are scattered over the bay and small beds line the shores. The ground is considered suitable for raising seed, but on account of the high specific gravity, not well adapted for the improvement of stock.

*The Straits*, as the name indicates, is a narrow sheet of water lying between Harker's Island and the mainland. It comprises 1,641 acres. Much of this area is in shallow water, the depth ranging from 1 to 3 feet; through the middle, however, is a deep channel of from 15 to 20 feet. The bottom generally is hard, consisting of a stratum of mud, more or less light, over sand; in the channel is some mud. All the shoal ground is more or less covered with grass. The specific gravity is high, ranging above 1.0250 and the currents rapid, setting east and west, over a knot per hour. Small oyster beds are found at close intervals along both shores, but do not frequently extend

into deep water or below low water mark. A number of oyster gardens have been taken up on the northern side of the Straits, but only a few owners have secured licenses. In some cases applications are pending and in others a species of squatter sovereignty is exercised. The principal part of this area seems well suited for raising seed oysters. The density of the water is too great to produce good marketable stock, but with the swift current and clean, clear water, there should be no difficulty in catching enormous quantities of spat for transportation to the fattening ponds or to Pamlico Sound.

*Chadwick's Creek* is a small arm of the Straits, making into the mainland, and comprising 29 acres. It is about 2 feet deep, of sticky bottom, and has a number of small oyster beds lying along the western shores, and an oyster garden is located on the opposite side. The area can probably be made an excellent fattening ground at moderate expense.

*Westmouth Bay* lies opposite Chadwick's Creek, both being situated about the middle of the Straits. It comprises an area of 335 acres. In the middle the depth is from 2 to 4 feet, but from  $\frac{1}{10}$  to  $\frac{1}{4}$  mile from the shore not more than 1 to 2 feet will be found. The bottom is generally soft with grass growing over it, except on the shoal ground, where sand or sand and mud mixed are encountered, and the bottom becomes more or less hard. Oyster beds are found at intervals along the shores, and an oyster garden lies in the extreme southwestern part of the bay. The area is suitable principally for the raising of seed oysters, the water being too salt to improve the stock to any great extent.

*Craney Island Bay* lies near the eastern end of the Straits and opposite Sleepy Creek. It is practically occupied by oyster gardens, and the owner of them and of the adjacent land claims that the bay itself is within his territory, and included in his deeds.

*Back Sound* is the name given to that portion of Core Sound lying between Harker's Island and the Shackleford Banks. The Sound comprises an area of 11,829 acres and is generally shoal,



the depth ranging from 1 to 3 and 4 feet. A deep channel, of from 10 to 20 feet, extends along the shore of Harker's Island, and another between Gull Island and the Banks for about two-thirds the length of the Sound from the western end. The shore of Harker's Island is comparatively bold, but on the southern side of the Sound only 1 and 2 feet will be found. The bottom near the northern shore is of hard or soft sand covered with grass. On the shoal extending east and west of Gull Island and separating the two deep water slues or channels, is mud covered with long grass. Beyond the southern slue and in the direction of the Banks the bottom is of mud, but firm, covered with grass, and with occasional small areas of sand interspered. Between the marshy islets and the Banks very soft mud and long grass will be encountered. The density of the water is, on an average, 1.0250 and the currents strong, exceeding  $\frac{1}{2}$  knot per hour. Oysters principally of the description known as "raccoon oysters" are found along the edges of the marshes, and in small beds and groups in their immediate neighborhood. None exist along the Harker's Island shore, on the shoals, or in the channels, and no artificial beds have been established. The oysters found at present have no commercial importance, but should active planting be introduced into Pamlico, these beds would furnish an excellent supply for that purpose; and while Back Sound will never in all probability, produce a high grade of oyster on account of its shoal and salt waters, yet as its currents are strong and the water clean it is excellently adapted to raising seed or small oysters for transplanting.

That part of the section and of Core Sound lying between Back Sound and the northern boundary of the section, near Davis Shore, resembles in essential features the other part of Core Sound, which lies in Section XXIII.

*Depth of water:* This is from 1 to 5 feet, the shoal water lying from  $\frac{1}{2}$  to 1 mile off the "Banks." In the middle of the Sound beyond that limit, the depth is from 3 to 5 feet with occasional large shoals with less water.

*Character of bottom:* This is, on the Banks side, of hard sand covered with grass, and the same characteristics predominate entirely across the Sound in that portion between the entrance to the Straits and Shell Point or Back Sound. Immediately north of the deep slue or channel leading into the Straits is a large area of soft mud. From Bell's Point at the mouth of Lewis Creek, to Davis Shore, the northern limit of the section, the bottom is of sticky mud and sand covered more or less with grass.

*Specific gravity:* The average is 1.0200, which increases as the southern limit of this area and the Straits is approached, to 1.0270.

There are no oyster beds in this region other than those at the mouths of the creeks and bays already described. The currents are strong, setting through and out of the Straits and Back Sound on the flood and in the opposite direction on the ebb. As great a velocity as  $1\frac{1}{2}$  knots per hour has been measured at the east end of the Straits and the average is fully  $\frac{3}{4}$  knot per hour. Heavy winds influence this flow considerably, either increasing or diminishing it, according to the direction of the tide.

All of this region, except that in very shoal water, along the Banks, is suitable ground for oyster culture and is especially adapted to the raising of seed oysters, for transplanting,

From the western end of Harker's Island, at the mouth of the North River, the contour of the bottom is irregular, two deep channels of from 10 to 20 feet leading from the Inlet forming Beaufort Harbor into Back Sound and the Straits. These channels are 4 miles long and from  $\frac{1}{4}$  to  $\frac{1}{2}$  mile wide, and on both sides of them the bottom rises abruptly to within one foot of the surface. A large marshy island known as Middle Marsh separates the two channels. In front of Beaufort is a marsh and extending from it to the southward and eastward is a high sand bank known as the Bird Island Shoal. Between this shoal and the line of marshes known as Carrot Island and Horse Island, is a narrow boat passage which is filled with small beds of raccoon oysters; and between Carrot Island and the mainland is a similar narrow and shallow sheet of water, likewise

occupied by oyster beds. In and about the Middle Marshes some small beds of raccoon oysters will be found; but in the channels and on the shoals, all of which have sandy bottoms, more or less covered with grass, there are no oysters. The deep water here could be utilized, as it is clean, and the currents are particularly swift, exceeding a knot an hour. Only seed oysters could be raised, however, as the specific gravity, which is from 1.0220 to 1.0235, is too high. On the shoals nothing could be accomplished on account of the extremes of heat and cold and the shifting nature of the bottom.

*North River*, comprising 5,272 acres, is probably the most important area in the section. It extends in a northerly and southerly direction  $5\frac{1}{2}$  miles, and is from  $\frac{1}{2}$  to  $1\frac{1}{2}$  miles broad. Two large creeks, Ward's and Goose, empty into the river from the eastern shore, and several small streams from the western. The depth ranges from  $\frac{1}{2}$  foot to 5 feet, but is generally from 2 to 3 feet. The deep water will be found a little to the eastward of the middle of the stream and towards Ward's Creek. The lower part of the river, near the mouth, is generally shoal and obstructed by marshes. Several comparatively deep channels lead up between these shoals and marshes and convey the salt water into the body of the river; but they are very narrow and occupy only a small portion of the area.

*Character of bottom:* This is either of sand or mud, the former being in some places soft and sometimes mixed with mud. In general the bottom is "sticky", and sufficiently firm to support oysters. On the high shoals, hard sand will be found, and sand predominates on all the eastern side of the upper portion. On these sandy bottoms there is a good deal of grass, which is, to a great extent, absent from the western side and soft bottoms. In the southern and extreme lower part of the river, hard sand shoals occupy a comparatively larger area.

*Specific gravity:* The average density of the river is 1.0259, the maximum 1.0271, and the minimum 1.0241, showing that the specific gravity is uniformly high.

*Oyster beds:* On the western side small beds lie along the shores of Cheney's Bay, Turner's Creek and the shores of the river to a point about 2 miles above Lenoxville Point. They then cease until a point about  $1\frac{1}{2}$  miles from the head of the river is reached, where small groups and beds will be found off each marshy point. About a mile from the head of the river are a large number of beds, some of considerable size, scattered over the whole bottom, from shore to shore. On the western shore the beds begin at the mouth of the river and entrance to the Straits, and are found along the marshes below Goose Creek and on the north shore of that estuary. These beds are, in some instances, quite large, in others merely small groups of oysters and shells. No oysters were found between Goose and Ward's Creeks, but they occur again as soon as the latter tributary is entered. From the northern entrance to Ward's Creek, all along the eastern shore of the river to its head, beds and scattered oysters are found, most of them being left dry at low water. Both the size and number of the beds increases as the head of the river is approached. The oysters were not generally of particularly good quality, but in those beds that are always covered with water a fine grade of stock is frequently produced. The currents are tidal, setting in and out of the river, but are influenced considerably by the wind. In the lower part, near the marshes and in the channels they are quite swift, but in the upper portion of the river only a sluggish set of about  $\frac{1}{4}$  knot per hour was observed.

All along the western shore of the river are numerous oyster gardens, every bay and indentation being occupied, and in the extreme northern part of the river along the eastern shore is another assemblage of gardens. The positions of all are indicated on the maps, but the areas are somewhat exaggerated.

*Goose Creek* is a bay rather than a creek, making into the eastern shore of North River about one-half mile above the Straits. The depth is from 1 to 3 feet and the bottom sticky. Oyster beds of considerable size lie about the points at the mouth and along the northern shores.



*Ward's Creek*, comprising 269 acres, is a tributary of North River flowing in from the eastern shore, about half way between the Straits and the head of the main stream. The depth is from 1 to 3 feet, the bottom sticky and on the shoals of hard sand. The density is 1.0250. Oyster beds lie along both shores and at the head of the creek, in great numbers, but no licensed oyster gardens have been established.

North River and its several tributaries offer an excellent field for raising seed oysters, but only in exceptional localities will a high grade of marketable stock be uniformly produced. While the bottom is generally good, the water is shoal and the specific gravity high. Of course in the mouths of the small creeks the saltness of the water is considerably reduced at times by the influx of fresh water; but these positions have nearly all been occupied and it will only be upon rare occasions that the density in the river itself will be reduced enough to produce an oyster of very high grade. A fair oyster can be grown, however, and especially oysters for transplanting. It is only necessary to expose the "cultch," and the brood will be secured.

*Newport River* lies on the western side of the peninsular upon which Beaufort is situated. The river is similar in general features to North River, being long, narrow and shoal, and having its mouth more or less closed by marshes and sand-bars. The several tributary streams, however, are of more consequence than those in North River, Harlow Creek especially having a considerable influence upon the specific gravity of the water on account of the connection of the creek by the Clubfoot Canal with the Neuse River. The Newport River, exclusive of the tributaries and areas especially described, comprises 6,320 acres.

*Depth of water:* This ranges from  $\frac{1}{2}$  foot to 10 feet, but the depth over the greater portion of the area is from 2 to 3 feet. A deep channel sweeps up past Fort Macon and the wharf at Morehead City, and at the latter point divides, one arm passing to the eastward of the Newport Marshes and between them and Gallant's Point, and the other to the westward of the marshes and to the eastward of Crab Point. Both channels curve to the

northward and eastward, northward and northward and westward, and both come to a head at a point about opposite Core Creek. Between these channels and the marshes and mainland the contour of the bottom is very irregular, the depth ranging from 1 to 20 feet, and the ground being occupied by deep slues and holes or high sand-bars. Above Crab Point and Core Creek the depth is more regular, though high shoals will be found off most of the points, and above Mill Creek, near the head of the river, the greater part of the area is of similar character.

*Character of bottom:* Above Mill Creek the bottom is soft, of mud, except in the channel, where it is hard, and nearly all ebbs dry. A narrow strip of grassy bottom lies along the northern shore. Along the southern shore to the point opposite Harlow Creek, sand or mud, making a hard bottom close to the shore, will be found. From Crab Point to the point opposite Harlow is a strip of sand or sand and mud 100 to 400 yards wide. Outside of this tract the bottom is sticky, of mud and sand, and covered with grass, until within 200 or 300 yards of the northern shore. The remainder of the river (that portion lying below Crab Point and Core Creek) has generally a hard bottom, consisting principally of sand, and with the grass diminishing as Beaufort and the marshes is approached.

*Specific gravity:* The average density for the river and its tributaries is 1.0200; but there is a great difference between the density in the upper and lower portions. At the head of the river the density was 1.0066; one mile from the head 1.0160; two miles from the head 1.0183; at the mouth of Oyster Creek 1.0205; at the mouth of Core Creek 1.0216; at the upper end of the Newport Marshes 1.0236; and at the railroad wharf at Morehead 1.0236. These figures indicate that the influence of the fresh water is much reduced as soon as the river turns to the southward, and the vicinity of the deep channels is reached.

*Oyster beds:* Above Harlow Creek, large and thickly stocked beds are found off every point and extending nearly across the river in some instances. They are all dry at low water, and the

oysters are of an inferior quality. From Harlow Creek to the southward there are no beds in the middle of the river; but both shores are fringed with small groups, and about the mouths of the creeks these groups become considerably larger, and in some cases form extensive beds. A large bed which does not ebb dry, lies off the point at the western entrance to Harlow Creek, and another similar one lies on the opposite side of the river, somewhat higher up. Through and around the marshes small strips of "coon" oysters are found which have at present no commercial value. The oyster gardens lie on the northern and eastern shores as shown on the chart.

*Harlow Creek* is one of the tributaries of the Newport River, and comprises an area of 124 acres. The depth is from 1 to 3 feet, the bottom soft in the middle and hard on the edges, and the density 1.0185. Oyster beds of considerable importance though of small size are found in the mouth of the creek and the animals are of good quality and flavor. The flow from the Clubfoot Canal keeps this creek at a more uniform density than the river or its other tributaries.

*Core Creek* is the largest stream flowing into the river. Its area is 529 acres, and the depth from 1 to 8 feet. The deep water is found about the middle, and the shoal at either end of the creek. Bell's and Eastman's Creeks are small and unimportant tributaries of Core Creek. The density of the water is 1.0220. This high specific gravity is due probably to the fact that the creek is directly in the line of the flow of salt water up the deep channels. This region is filled with oyster beds; indeed so numerous were they that it was found easier to locate the spots where they were not, than those where they were, in existence. They will be found along the shores and, above Bell's Creek, all over the bottom. Several oyster gardens have been located on the west side of the creek, close to the mouth.

*Town Creek* is a small sheet of water, making into the land back of Beaufort. Its area is 37 acres, the depth from 1 to 2 feet, and the shores fringed with oyster beds.

*Gallant's Channel and Lewis' Thoroughfare* are merely channels through the marshes. The average depth is about 6 feet, and the bottom hard. Oyster beds lie along Gallant's Point shore, and "coon" oysters in the marshes and about their edges.

*Calico Creek and Bay* lie on the western side of the river, north of Morehead City and south and west of the Newport Marshes. Their area combined is 310 acres; the depth of water from 1 to 3 feet, and the bottom sticky, of mud and sand, and hard about the shores. The specific gravity is 1.0231. Oyster beds are, practically, continuous all along the shores of the bay and over the major portion of the creek.

I consider the Newport River and its tributaries as well adapted to both forms of oyster culture. In the lower portions, where the water, though salt, is clean and the currents strong (averaging  $1\frac{1}{4}$  knots per hour), "spat" or young oysters could be raised without difficulty. In the upper part of the river they can probably be fattened, unless the bottom should be of a shifting character, which is possible. Some years ago some person deposited on a shoal north of the Newport Marshes, a quantity of oyster shells, for the purpose of making a foundation for a fish house. The intention was never carried out, but the shells were left, and now there is a healthy oyster bed on the spot, and this can, in the same way, be done elsewhere in the river. The principal drawback, both in the Newport and North Rivers, will be the want of depth; but until an experiment has been tried on a large scale the whole of the area must be accepted as suitable ground.

Between the railroad wharf and Fort Macon and Beaufort and the Shackleford Banks the ground is not considered as adapted to oyster culture, the sands being liable to shift and the water too salt.

Reviewing this section it will be seen that a portion of its area is adapted to one species of oyster culture, the raising of seed oysters, and another and smaller portion to the improvement of the stock.



While very few persons care at present to raise seed oysters, there being no demand for them in this State, it, nevertheless, is a very important and profitable branch of oyster farming; and should large tracts in Pamlico Sound ever be put under cultivation, an exceedingly large demand for small, yearling oysters would spring up, to satisfy which would fully occupy a large number of people and a large proportion of the area just described.

It is with this in view that I have assigned, as of value, 20,500 acres for this section.

#### SECTION XXV.

*Description:* Begins at the east end of the railroad wharf at Morehead City at a point in Lat.  $34^{\circ} 43' 05''$  N., and Long.  $76^{\circ} 41' 21''$  W., thence runs S.  $29^{\circ} 37'$  E. (true)  $1\frac{1}{2}$  miles with a line to the U. S. C. S. triangulation point known as "Fort Macon," in Lat.  $34^{\circ} 41' 41''.6$  N., and Long.  $76^{\circ} 40' 23''.3$  W. to the intersection of said line with the shore line of Bogue Banks, thence to the westward with the northern shore line of Bogue Banks to a point at the intersection of said shore line with a line drawn from the U. S. C. S. triangulation point known as "Frazier's," to the U. S. C. S. triangulation point known as "Hickory Point," thence from said point of intersection, with the said line from "Frazier's" to "Hickory Point" to a point at its intersection with the shore line of the mainland in the Cross Stake Channel, thence with the shore line of the mainland, to the eastward, to the beginning, containing, more or less, 21,997 acres. This section includes the whole of Bogue Sound and its tributaries.

*Depth of water:* In the eastern part of the Sound the depth of water ranges from 1 to 12 feet, but the deep water is confined to a narrow and rather crooked channel, and the average depth is only from 2 to 4 feet. Numerous sand shoals, having only 1 and 2 feet over them, are interspersed about this region. About 5 miles from Morehead, the depth becomes more regular and from 2 to 4 feet can be found over the whole area; deeper

water, of from 3 to 5 feet, lies along the northern shore. As the western end of the Sound is approached the water shoals and only from 2 to 3 feet is found in the neighborhood of Sanders' Creek, Goose Creek and Piney Island. At about this point is the meeting place of the two tides, the one from Beaufort harbor and the other from Bogue Inlet. The Sound here narrows considerably and the southern portion, for a space of several miles, is occupied by shoals, islands and marshes. Beyond this constriction the Sound widens again for several miles, but with the exception of a narrow, winding channel, some 5 to 10 feet in depth, the water deepens but slightly. The western entrance to the Sound is blocked by marshes, through which are several channels of from 3 to 10 feet in depth, none of which are over  $\frac{1}{2}$  mile wide and most of them considerably less.

*Character of bottom:* This is almost uniformly of sand covered with a light stratum of mud. Off the creeks are comparatively small areas of soft mud, and in the eastern portion of the Sound the sand is bare and possibly shifts under the influence of heavy gales and strong currents. Nearly the whole bottom is covered with a growth of grass, more or less thick; but in the deep water in the creeks, where the bottom is soft, comparatively little or none is found.

*Specific gravity:* The average for the Sound is 1.0203, but considerable variations from that density was found in several places and in the creeks. On the Sally Bell Shoal, in the eastern part of the Sound, the density was 1.0248. Off the mouth of Broad Creek, near the middle of the Sound, it was 1.0204. In the mouth of Goose Creek 1.0204; near the head of Goose Creek 1.0199. In Piney Creek 1.0192. Among the islands and marshes about Piney Island 1.0218. In Deer Creek, at its head, the specific gravity was 1.0131, while at the head of the adjoining Hunting Creek it was below 1.0100. In Hunting Creek 1.0134 was found, and at the western boundary of the section 1.0240. These figures show a pretty uniform specific gravity, reduced somewhat in certain places by the flow from the creeks. But their influence

does not extend very far, as is shown by the general high average prevailing in the body of the Sound.

*Oyster beds:* These are confined almost entirely to the western portion of the section. They are first encountered in the neighborhood of Cat Island, and from that point to the westward are almost continuous along the shores. About Piney Island and the adjacent marshes are very large numbers of beds, some of which have fine oysters. Along the edges of Goose Creek are many small beds, and the entire upper part of that body of water, nearly to its head, is covered by oysters. Hunting Creek is also nearly an entire oyster bed, and Deer Creek has an exceedingly large number of beds along its western shores. From Piney Point to the marshes at the western end of the section, along the southern shores of the Sound, a continuous line of small beds exists, extending out from 100 to 200 yards. In the marshes are numbers of "coon" oysters growing along the edges of the grass, and many small beds under water were found in the shallow channels; but none were encountered in the Burthen or Bank Channels, nor in the Cross Stake.

Oyster gardens have been established in Hoop Pole Creek, near the east entrance to the Sound, in Gales and Broad Creeks, near the middle and in the bay immediately to the westward of Goose Creek. All oyster beds, public or private, have been located and defined. The currents in the deep channels at the eastern and western ends of the Sound are strong, reaching, at times, a knot an hour; but as the middle of the Sound is approached and the water shoals, the velocity of the current decreases, and about Piney Island and the Goose Creek Shoals it is practically of little consequence.

I consider the whole of Bogue Sound and its tributaries, with the exception of a comparatively small area lying in the eastern portion and some of the bottom among the western marshes, as well adapted to oyster culture of one kind or another. The water is generally clean, the bottom hard, and the currents sufficiently strong. The high specific gravity, with the shoalness of the water, are drawbacks, but in the deep waters off the creeks and

east and west of the Goose Creek Shoals, good oysters can be raised.

Early in June I placed in the upper part of Bogue Sound, on the Goose Creek Shoal, various "collectors," for the purpose of catching the "spat," or young oysters, that were presumed to be drifting about in the Sound. A position was purposely selected where there were no mature oysters in the vicinity, and three forms of collectors were exposed; one of oyster shells, one of brush fascines, and the other of brush stuck in the mud in the shape of a fence. The point selected was considered to be as unfavorable to success as any in the neighborhood, there being little or no current and soft, muddy bottom, covered with grass. Time did not permit the arrangement of the brush or fascines in the most advantageous manner, nor the deposit of a sufficiently large number of shells. Altogether, the failure of the experiment could be easily accounted for in several ways, while its success, should it be successful, would conclusively prove that the exposure of collectors, even in the most unfavorable places, would be attended with beneficial results. The collectors were visited during the first week in August and the following observations made: The shells which had been strewn on the bottom were covered with sediment and had secured no oysters; a large number of "slipper shells" (*crepidula plana* and *crepidula fornicata*) were found, however. The brush which had been stuck in the mud so as to form a species of fence had caught nothing, and was covered with sediment. The fascines (bundles or fagots of brush and twigs) had, however, secured a number of young oysters and also a very large number of *crepidula* and *balanus*, or the common barnacle. The young oysters had attached in greatest number about the large ends of the twigs where there were no leaves to collect sediment or slime; and as we found a number also on the few dead leaves remaining, I am of the opinion that the leaves on the twigs managed to secure most of the spat and then rotted off. The leaves also prevented that free circulation of the water which would be necessary for cleanliness, as well as directly preventing the access of the young



oysters to the twigs. I am also of the opinion that all the collectors were exposed too early in the season, thus allowing them to become foul before the advent of the young brood. A re-examination of these collectors was made about the last of November with most gratifying results. On two of the brush fagots or fascines were counted 365 young oysters of from one-sixteenth of an inch to two inches in diameter, and, as the count was a hurried one, probably the actual number attached was much larger. It must be remembered that these collectors were purposely exposed in the most unfavorable position; that no mature spawn-bearing oysters were deposited with them, and that the collectors themselves were rudely fashioned, and that the experiment was not expected to prove anything but that what was regarded as highly unfavorable ground could be made productive at slight expense. Considering this, a very high measure of success has been achieved, and the ability to grow cheaply and in large numbers young oysters in Bogue Sound is now a settled fact. Specimens of these oysters are now at the Agricultural Department.

In view of the success of the experiment just described, and of the generally high character that the Bogue Sound oyster, especially those growing about Piney Island bears, I have no hesitancy in reasserting my original estimate of the area in the Sound adapted to oyster culture, which was 15,000 acres. Of this 607 acres are occupied by natural beds, leaving 14,400 acres to be developed.

The remaining sections have not yet been examined, or only partially so. The upper part of the White Oak River has been surveyed and New River is in process of examination. The description of those regions will, therefore, for the present, be deferred. The following are the boundaries which have been provisionally decided upon for the remaining sections :

#### SECTION XXVI.

Includes all waters suitable for the growth of shell fish which lie between a line drawn from the U. S. C. S. triangulation

point known as "Frazier's," to the U. S. C. S. triangulation point known as "Hickory Point," and a line drawn from the U. S. C. S. triangulation point known as "Frank" and the U. S. C. S. triangulation point known as "Broom."

This latter line lies half way between New River and Brown's Inlet.

#### SECTION XXVII.

Includes all waters suitable for the growth of shell fish which lie between a line drawn from the U. S. C. S. triangulation point "Broom" to the U. S. C. S. triangulation point "Frank," and a line drawn from the U. S. C. S. triangulation point "Stump Inlet" to the U. S. C. S. triangulation point "Abert."

This section includes New River and Stump Sound.

#### SECTION XXVIII.

Includes all waters suitable for the growth of shell fish which lie between a line drawn from the U. S. C. S. triangulation point "Abert" to the U. S. C. S. triangulation point "Stump Inlet," and a line drawn from the U. S. C. S. triangulation point "Compass" to the U. S. C. S. triangulation point "Lake."

This section includes Topsail, Middle, Masonboro and Myrtle Sounds.

#### SECTION XXIX.

Includes all waters suitable for the growth of shell-fish which lie west or south of the line drawn between the U. S. C. S. triangulation points "Compass" and "Lake."

This section includes the ground at the mouth of the Cape Fear River, and of the various Sounds and inlets to the westward as far as the State line.

#### SUMMARY.

In the foregoing pages each section, and so far as possible each locality has been described as minutely as the limits of this report and the information at my command has permitted. The following table presents the principal results of the investigation in a form convenient for reference:

SECTION.	LOCALITY.	AREA.	AREA SUITABLE FOR OYSTERS.		AREA OYSTER BEDS. ACRES.	AVERAGE SPECIFIC GRAVITY (1,000 fresh water).	AVERAGE DEPTH WATER. FEET.	AVERAGE CHARACTER BOTTOM.	PROGRESS OF SURVEY.
			POSSIBLE ACRES.	PROBABLE ACRES.					
I	Croatan and Roanoke Sounds.....	48,389	14,800	9,000	Not cal'd	1.0093	8 to 9, 4 to 6	Sand.	Incomplete.
II	Upper Pamlico.....	45,757	31,800	26,100	970	1.0115	10 to 12	Sand and mud.	Completed.
III	Upper Pamlico.....	45,757	9,200	.....	.....	1.0124	1 to 5	Sand.	Completed.
IV	Upper Pamlico.....	82,004	79,800	79,850	830	1.0124	14	Sand and mud.	Completed.
V	Eastern Pamlico.....	60,025	51,000	41,000	.....	1.0125	1 to 10	Sand.	Incomplete.
VI	Middle Pamlico.....	35,776	15,300	15,200	.....	1.0127	18 to 20	Mud.	Completed.
VII	Western Pamlico.....	43,048	22,489	22,489	335	1.0125	2 to 17	Sand and mud.	Incomplete.
VIII	Eastern Pamlico.....	61,634	43,300	48,500	220	1.0148	2 to 12	Sand.	Incomplete.
IX	Middle Pamlico.....	103,570	32,080	32,380	.....	1.0133	20	Mud.	Completed.
X	Western Pamlico.....	30,291	25,300	23,300	200	1.0125	3 to 14	Sand and mud.	Incomplete.
XI	Middle Pamlico.....	76,570	54,100	54,100	520	1.0148	1 to 20	Sand.	Incomplete.
XIII	Western Pamlico.....	67,738	57,000	57,000	.....	1.0117	14 to 22	Sand.	Completed.
XIV	Southern Pamlico.....	15,745	15,000	15,000	250	1.0116	8 to 10	Sand and mud.	Incomplete.
XV	Middle Pamlico.....	39,988	17,000	17,000	.....	1.0095	18 to 20	Mud.	Completed.
XVI	Southern Pamlico.....	43,415	15,300	13,300	.....	1.0087	2 to 14	Sand and mud.	Completed.
XVII	Southern Pamlico.....	38,315	38,315	38,315	1,500	1.0087	12 to 22	Sand and mud.	Completed.
XVIII	Middle Pamlico.....	38,888	25,200	23,200	.....	1.0088	8 to 20	Sand and mud.	Completed.
XIX	Western Pamlico.....	65,164	43,800	43,800	.....	1.0087	2 to 20	Sand and mud.	Incomplete.
XX	Pamlico and Pamlico River.....	50,639	47,314	33,891	1,050	1.0094	.....	.....	Not surveyed.
XXI	Neuse River.....	63,437	26,000	.....	.....	.....	.....	.....	Not surveyed.
XXII	Cedar Island Bay.....	50,299	28,000	23,000	230	1.0034	2 to 25	Sand and mud.	Incomplete.
XXIII	Northern Core Sound.....	28,615	28,600	23,600	1,074	1.0082	2 to 25	Sand and mud.	Under examination.
XXIV	Southern Core Sound.....	44,597	32,800	32,800	703	1.0122	1 to 10	Sand and mud.	Completed.
XXV	Bogue Sound.....	38,997	20,500	20,500	1,206	1.0225	1 to 15	Sand and mud.	Completed.
XXVI	White Oak River.....	25,929	20,000	15,000	607	1.0203	2 to 5	Sand.	Completed.
XXVII	New River and Stump Sound.....	.....	.....	.....	.....	.....	.....	.....	Incomplete.
XXVIII	Topsail to Myrtle Sound.....	.....	.....	.....	.....	.....	.....	.....	Under examination.
XXIX	Cape Fear region.....	.....	.....	.....	.....	.....	.....	.....	Not surveyed.
		1,216,997	805,968	697,515	10,165	.....	.....	.....	Not surveyed.

It will be observed that of the entire area, 1,316,997 acres, examined (which includes all the waters north of the White Oak River), 806,968 acres are of possible and 697,515 acres of probable value for oyster culture. Of course some portions of this latter area are superior to others; but so far as it is possible to determine by investigation unaccompanied by experiment, oysters can be raised on the whole. Experiments could be made, but they would require considerable time, and entail a much greater expense than it is desirable to incur, and, therefore, except in a few instances, it has been considered best to leave to the enterprise of individuals the application of the final tests.

All that any expert investigation can accomplish is to determine the probabilities. The farmer can say whether or not a piece of land is good for cotton, corn or tobacco, and the geologist can give information as to possible or probable veins of ore lying under that land. The former judges by the character of the soil, and the latter by the geological formations; but neither can speak positively until crops have been raised, or shafts sunk and veins exposed. In the same way it is impossible for any one to decide positively that oysters can be grown profitably on any particular area until the experiment has been made. But by studying the various conditions existing in any locality, and through a knowledge of the extent of their influence upon the life of an oyster, or an oyster bed, an approximation, more or less close, to a definite and absolute decision may be reached; and that is all that is claimed for the conclusions as to the oyster ground contained in the foregoing pages and table.

It will be observed that only about  $1\frac{1}{2}$  per cent. of the available ground has been utilized by nature. Adding to the area of the natural beds, 10,165 acres, that of the artificial beds, 2,000 acres, the total is in round numbers but 12,000 acres; a very small portion of the vast expanse suitable for oyster growing. It must be remembered that the areas given for the natural beds are in excess of the truth, and that many of the artificial beds are beds only in name, the ground having been designated but



not improved. Consequently the above figures represent the maximum area now productive, and this is not 2 per cent. of the area that could and should be made to yield a harvest, but which is now entirely barren.

The location of the various natural and artificial beds having been stated and the results of the general examination of the waters of the State having been made known, the immediate ends of the investigation have been attained. A general discussion of the whole will, however, assist those interested in the oyster question in arriving at just conclusions as to the course which should be adopted for the protection and expansion of the industry.

It will be seen by the table that the natural beds of the State comprise some 10,000 acres. These beds produced in 1880, according to the U. S. census, 170,000 bushels of oysters, valued at \$60,000, and afforded employment for 1,020 persons, and \$68,500 of capital. The yield of the beds was therefore about 17 bushels per acre, and the value of the ground in gross income, \$6 per acre. As a considerable portion of the area of the oyster beds is non-productive at present, either on account of the inferiority of the oysters or want of a market for the particular grade of stock they supply, those grounds that are worked must be yielding somewhat more than 17 bushels per acre; but allowing a margin of 50 per cent. for non-productive areas, only 34 bushels per acre are secured. According to the report of the Maryland Oyster Commission, the beds of that State comprise an area of 123,520 acres, and the census gives their product as 10,600,000 bushels, or an average of 87 bushels per acre. In 1880, the Maryland oyster beds were already in a much impaired condition, and consequently they produce much less than a natural bed in a normal condition; but comparing the average yield of the Maryland beds with that of the North Carolina areas, a difference of 53 bushels per acre is shown in favor of Maryland. Either one of two conclusions can be drawn from this comparison; the fishing in Maryland is more systematic and thorough, or the beds of North Carolina yield much less for the same exertion. Naturally they are more productive, as they lie

in shoaler water and the oysters are more easily obtained; therefore, if other indications point in the same direction, the evidence as to the proportionately small product must be accepted as additional proof that the beds have deteriorated.

Such additional proof is not wanting. All oystermen encountered have expressed the opinion that the beds were by no means in as good condition as in the past, and invariably the cause has been stated to be over-fishery. In addition nearly all the beds examined have shown an undue proportion of empty and broken shells and a corresponding poverty of oysters. This is certainly not due to the ravages of enemies, as none of any consequence have been found. In the upper part of Pamlico Sound are many areas that have suffered either from a deposit of sediment or from the action of fresh water, and in a few other localities are beds in shoal water that have been damaged by ice, but with these exceptions there is no evidence of any deleterious natural influence having been at work. Remaining then is the influence of the fishery.

While the evidence of the fishermen as to the effect of the fishery is in a measure conclusive, it will be of advantage to examine the experience of other localities for testimony as to the results of unrestricted working of oyster beds. Eight years ago I had occasion to review the history of those localities when making an investigation of the Chesapeake oyster area, and a few marked instances of the effect of over-fishery, which were then collected, are here reproduced.

The most instructive are the records of Cancale Bay, on the northwest coast of France, which extend over a period of sixty-eight years, from 1800 to 1868. The beds in the bay comprise an area of about 150 acres, and from 1800 to 1816 produced from 400,000 to 2,400,000 oysters a year. This, however, was the period of the Napoleonic wars, and the fishing was much disturbed by the presence of the English cruisers. During this time the beds became so thickly stocked that the oysters were, in some places, a yard thick. After the close of the war the fishing improved and the oysters were removed in larger and increasing numbers until 1843.

From 1823 to 1848 it is supposed that the dredgers were living upon the oysters accumulated during the period of enforced rest, from 1800 to 1816. In 1817 the number of oysters produced was 5,600,000, and until 1843 there was a constant increase, the number taken in the latter year being 70,000,000. In 1848 it was 60,000,000; thence forward there was a constant decrease. From 1850 to 1856 the decrease was from 50,000,000 to 18,000,000, supposed to be the effect of overdredging. From 1859 to 1868 the decrease was from 16,000,000 to 1,079,000, the oysters having almost entirely disappeared from the beds, though on account of the suffering condition of the inhabitants of the shores it was almost impossible to prevent it. In 1870 there was a complete wreck of the bottom, which could only be remedied by a total prohibition of the fisheries for several years.

“From the beds of the districts of Rochefort, Marennes and Island of Oléron, on the west coast of France, there were taken in 1853-’54, 10,000,000 oysters and in 1854-’55, 15,000,000. On account of exhaustive fishing, in 1863-’64 only 400,000 could be obtained.

“According to the testimony of Mr. Webber, Mayor of Falmouth, England, about 700 men, working 300 boats, were employed in a profitable oyster fishery in the neighborhood of Falmouth until 1866, when the old laws enforcing a ‘close time’ were repealed, under an impression that, owing to the great productive powers of the oyster, it would be impossible to remove a sufficient number to prevent the re-stocking of the beds. Since 1866 the beds have become so impoverished from excessive and continued fishing that in 1876 only 40 men and 40 boats could find employment, and small as the number is, they could not take more than 60 or 100 oysters a day, while formerly, in the same time, a boat could take from 10,000 to 12,000.

“According to the statement of Mr. Messum, an oyster dealer and secretary of an oyster company at Emsworth, England, made before the Commission for the Investigation of Oyster

Fisheries, in May 1876, there were in the harbor of Emsworth, between the years of 1840 and 1850, so many oysters that one man in five hours could take from 24,000 to 32,000. In consequence of overfishing, in 1858 scarcely ten vessels could find loads, and in 1868 *a dredger in five hours could not find more than twenty oysters.*

"The oyster fisheries of Jersey, in the English Channel, afforded employment to 400 vessels. In six or seven years the dredging became so extensive and the beds so exhausted that only three or four vessels could find employment, and the crews of even that small number had to do additional work on shore in order to support themselves.

"Ingersoll states that in the early days of our history, it was not uncommon for a man to rake up a sleigh load of oysters through the ice in a single afternoon at Shediac, New Brunswick. Twenty-five or thirty years ago these beds yielded 1,000 barrels a year, and now two persons gain a scanty living upon them, and obtain between them about 200 bushels a year."—(*Report Maryland Oyster Commission.*)

"In 1876 a fisherman says that in two years over 4,000 barrels of oysters were taken away from the beds at Betlamin, in New Brunswick, by ships and schooners which bought their cargoes from the small, raking boats upon the beds. At this time the oysters were distributed everywhere over the harbor so thickly that every square foot seemed to be occupied, and the beds swarmed with small boats, each operated by two men. Four years later, in 1880, the oysters were almost exterminated." (*Report Maryland Oyster Commission.*)

"Old men still remember when rich beds were to be found in Hillsborough Bay, in New Brunswick. The oysters were so abundant that they seemed inexhaustible, and a tonging boat could take eight bushels an hour. They have been almost entirely destroyed by tongs alone and they now yield only a few bushels a year."—(*Report Maryland Oyster Commission.*)

"The early settlers of New England continually refer to the abundance of oysters at points where not a single oyster can now



be found. In 1634, William Wood, in a work on New England, speaks of a great oyster bank in the Charles River, near Boston, and another in the Mystic River, each of such size as to obstruct navigation. The oysters were long, slender "coon" oysters, which are still to be found in our own waters on undisturbed natural beds. Of their size and form he says: 'They be great ones, in form of a shoe-horne; some be a foot long. These breed on certain banks that are bare every spring-tide. This fish, without shell, is so big that it must admit of a division before you can well get it into your mouth.' The oyster beds in those two rivers are spoken of by many of the early writers, but they are now gone so completely that there is no tradition to mark the place, where in 1634, according to Wood, 'the oyster bankes do barre out the bigger ships.'—(*Report Maryland Oyster Commission.*)

"Native oysters were abundant at Wellfleet, on Cape Cod, at the time of the first white settlements, and for more than a hundred years the town was famous for its oysters, but they became extinct in 1775, through excessive tonging."—(*Report Maryland Oyster Commission.*)

"The oyster beds of Rhode Island were long ago so depleted that they have long ceased to be of any value as a source of food, and there is now only one river in the State where seed oysters for planting can be procured in any quantity."—(*Report Maryland Oyster Commission.*)

The natural beds of Connecticut, New York, New Jersey, Delaware, Maryland and Virginia have all been much impaired by excessive fishery, and the records show that this impairment is likely to continue until it results in complete destruction.

The conclusions of the Maryland Oyster Commission on this subject are so valuable and pertinent that they appropriately close the testimony of the past.

"No one who is familiar with the history of the oyster beds of other parts of the world can be surprised at the deterioration of our own beds. Everywhere, in France, in Germany, in England, in Canada, and in all northern coast States, history tells the same

story. In all waters where the oysters are found at all, they are usually found in abundance, and in all these places the residents supposed that their natural beds were inexhaustible, until they suddenly found that they were exhausted. The immense area covered by our own beds has enabled them to withstand the attacks of the oystermen for a much longer time, but all who are familiar with the subject have long been aware that our present system can have only one result—extermination.”—(*Report Maryland Oyster Commission.*)

Reviewing the testimony, there can be no doubt that the beds of North Carolina, if they continue to be exposed to an unrestricted fishery and obtain no measure of relief, will share the universal fate and be destroyed.

The beds being in not only an impaired condition at present, but threatened with complete destruction in the future, some remedy must be applied which will counteract the destructive influence. This may be accomplished by restricting the fishery, or by endeavoring to increase the number of oysters in the beds. To restrict the fishery will in effect deprive many of the poorer class of people of a portion of their subsistence and means of livelihood; nor is it necessary, except in extreme cases, to do so. It must be remembered that the root of the evil is that *the demand has outgrown the supply*; and so long as that continues, restrictive measures will not only be very difficult to enforce (as the periodic oyster war in the Chesapeake bears witness), but will cause an increase in the price of a desirable and nutritious article of food.

Restriction, except in special cases, is then, not a practicable or desirable remedy. The other alternative is to strike at the root and *endeavor to increase the supply*; and this can be done only by the cultivation of additional areas which are now unproductive. A feeble effort has been made in this direction under the authority of those sections of the Code which permit individuals to cultivate tracts of bottom. The laws relating to this subject and to oysters generally are given in appendix B,

and the following is a brief synopsis of those sections governing the cultivation of oysters and the preëmption of bottoms :

Section 3390 provides that any inhabitant of the State may have not more than ten acres of bottom, provided he first obtains a license from the Clerk of the Superior Court, stakes out the ground with substantial stakes, and has not more than one such bed in a county ; and provided, also, that the riparian rights of owners of adjacent lands shall not be affected, nor any natural clam or oyster bed be enclosed nor navigation be obstructed.

Section 3391 authorizes the Clerk of the Superior Court, in his discretion, to grant licenses.

Section 3392 authorizes the County Commissioners, in their discretion, to make surveys of the private beds or gardens, and declares any owner who is found to have more than ten acres, or any natural bed enclosed, to have forfeited all rights in the premises, and the same penalty is provided should the owner fail for two years to use his bed or garden or keep up his stakes.

Section 3393 provides for the punishment of depredators upon the private beds or gardens.

These provisions are defective and inadequate in the following particulars:

1st. The grants are confined to inhabitants of the State, the impression being that the area of suitable and desirable ground is limited, while on the contrary it is practically unlimited, our investigation having shown some 700,000 acres as available.

2d. The tracts which may be taken up are confined to ten acres. This is due to the same impression as to the limited area of suitable ground. It is unwise, as success in raising and cultivating oysters is as dependent upon the fundamental laws of political economy as any other business, and no business has ever been known to succeed when there was no hope of expansion, stimulus to exertion or gratification to ambition. Neither has any enterprise a chance of success or of becoming of great importance, when it neither claims nor receives the unremitting and undivided attention of those engaged in it. Exclusive attention cannot be given to so small an area as ten acres. The results

would not justify it. In fact, if the owner relied upon such a lot alone for his livelihood he would probably starve; and indeed, no one does do so; the business, if it can be called one, of raising oysters being merely adjunctory to other pursuits, and men keeping oyster "gardens," as they do kitchen gardens, and oysters as they do a few pigs, almost entirely to supply their own tables. Evidently the oyster interest has no more to hope from such a state of things than agriculture has from the kitchen garden.

3d. The provision allowing each person but one bed is unjust. Circumstances or location enables one man to take his full ten acres in a lot and another but two acres; but the law allows but *one lot*, which shall not exceed ten acres, and thus some men obtain more than others.

4th. The provision protecting the natural beds is right and proper, but it works disadvantageously on account of the use of a general instead of a specific description of the areas it is desired to protect. As explained in the first pages of this report, there is great difference of opinion as to what constitutes a natural oyster bed, and so long as no legal and exact definition exists to govern those desirous of establishing artificial beds, more or less insecurity must be felt.

5th. The provision granting to the Clerk of the Superior Court discretionary power to issue licenses has no foundation in justice. It opens the door to favoritism and partiality, and it is particularly to the credit of the Clerks of the Courts of the several seaboard counties, that they have not taken advantage of the provision to forward ends other than those of a public nature.

6th. The provision giving the County Commissioners discretionary power to make surveys is also a disadvantage. Unless the Commissioners choose to act there is no means of determining whether the law has been complied with or not.

7th. The absence of a requirement that lots shall be surveyed and located with reference to some well defined and permanent landmark before the issuance of the license, will sooner or later cause confusion of titles and needless litigation. At present



many clerks require surveys to accompany the applications for licenses; but these surveys are rude in the extreme and it is the exception and not the rule when they plot. In many cases the description of the lot is radically in error, in one case the metes and bounds given being, practically, one straight line; and this lot is supposed to contain 10 acres. In numbers of instances no description at all is given beyond the statement that the lot lies in such and such a creek or bay and contains 10 acres. How the area of the lot was determined is impossible to conceive. Many lots are said to begin at a "point," or "opposite a house" or "wharf;" but the general description is, that the lot "begins at a stake." A stake is a perishable object and frequently disappears; in such case the owner sets up another, sometimes in the same place and sometimes not; but there is nothing to prevent his taking up an entirely new area or infringing upon other lots; and nothing to protect him from similar infringement upon his own.

Two examples of characteristic surveys are quoted: "Begins at a stake running N.  $66^{\circ}$  W., 30 poles, thence S.  $66^{\circ}$  E., to the shore, thence with the various courses to the beginning, containing 10 acres."

The two courses given here are one and the same, and the description is utter nonsense.

"This is a plan of an oyster bed laid off for ———, in ——— creek, in said county, on Hunting Quarters, containing ten acres on the east side of said creek, adjoining the lands of said ———." A rough sketch, without courses or distances, accompanies this description, and naturally no plot can be made nor its area determined.

It will be observed that the law requires good and substantial stakes to be maintained, and also that free navigation shall not be interfered with. But stakes of the description required do interfere, to some extent, with navigation by small boats and their maintenance is, in some localities, a source of complaint.

Reviewing the several provisions of the statutes it will be seen that the Clerk of the Court may or may not grant a

license, at his discretion. That he who obtains a license for ten acres may take more than that amount, and that there is no method of detecting his appropriation of extra ground unless the County Commissioners should choose to exercise their powers and cause a survey to be made. That those who have honestly taken up nothing more than the law allows are constantly in danger of losing the fruits of their labor, through inaccurate surveys, or through the presence in the area of something or some spot which some person may choose to consider a natural bed and which, for all the owner knows, may be one within the meaning of the law.

Supposing that the cultivator of the ground has observed the law and has managed to preserve his property, he is confronted on his death bed with more or less inability to dispose of the ground. The license is good in him and his assigns—but if his children are already in possession of lots they cannot maintain their title to any additional areas they may inherit; nor can neighbors or others purchase if they happen to have attempted oyster cultivation, and as already explained the lots are too small to induce cultivation by any but those living conveniently near them. Thus through the provisions of an act intended to foster the growth of shell-fish, and at the same time prevent a monopoly of the ground, the growth of the industry has been checked, its profits rendered hazardous and a most rigid monopoly vested in a few people living near the water fronts.

Naturally conditions such as these must awaken discontent, not only among those who work on the natural beds, but among that better and more influential class who have made some effort to improve such ground as they could legally hold. Laboring under insecurity of title, open to depredation under guise of law, and confined to areas so small as to hardly repay the attention given them, it is surprising that even 250 persons should have had the courage to enter the business. And, in fact, the only cases where a real success has been achieved, is where at least three or four lots, containing, ostensibly, ten acres each, are held in the same family and the property secured by a gun.

Appendix A contains a list of the owners of oyster gardens and the area, as far as can be determined, of each lot.

It has been shown that the natural beds can only be adequately protected by the enlargement of the present productive oyster area; but it is also eminently advisable that that area should be enlarged for other reasons. It has been shown that not two per cent. of the ground has been utilized, the remaining ninety-eight per cent. being utterly barren, and certainly, if any portion of this enormous, unproductive area can be made to yield oysters, a great benefit will be conferred upon the country at large, the State in general, and the eastern section in particular.

Referring to the census returns it will be seen that the oyster industry of the United States is worth in its products three times as much as the cod fishery, four times as much as the salmon fishery, four times as much as the whale fishery, six times as much as the menhaden fishery, over ten times as much as the shad and alewife fishery together, and fully as much as all the other fisheries of the country. It employs 52,805 persons and \$10,583,295 of capital, and produces 22,195,370 bushels of oysters, valued at \$13,438,852. The preservation of such an industry is of far more than local importance, and the fact is recognized by the general government, as is shown by the very substantial aid which has been afforded the State in making these investigations.

Of the enormous capital engaged in the business, North Carolina contributed not even one per cent.; of the thousands of people employed, only two per cent. are of this State, and of the \$13,438,000 of products, less than one-half of one per cent. came from an area capable of producing an amount equal to if not exceeding that of the whole country. Certainly such a condition of things not only needs a remedy, but should have it applied immediately.

According to my own observations and study of the question, the great oyster beds of the Chesapeake Bay are failing, more or less, rapidly; and in this opinion I am supported by every one who is entitled to speak authoritatively on the subject. The Maryland Oyster Commission was composed of such eminent men as Dr. W. K. Brooks, a member of

the National Academy of Sciences and a professor of Zoology at the Johns Hopkins University, and Captain J. I. Waddell, who was, at the time of his death, Commander of the Maryland Oyster Police; and this Commission in a voluminous, exhaustive and exceedingly able report to the Maryland Legislature directly confirms prophecies made by myself several years before. As the result of careful examinations, admitting of no question, that report states that the Maryland beds had fallen off 39 per cent. in three years. And again (I quote directly):

"Your commissioners have no desire to create a sensational effect, but the accompanying table, which is compiled entirely from the facts which they have observed for themselves by personal examination of all the beds, must speak for itself. It is the most trustworthy evidence which we have been able to obtain, and it certainly justifies the widespread belief that the oyster property of the State is in *imminent danger of complete destruction* (the italics are mine) unless radical changes in the methods of managing the beds are made at once.

"This evidence (of the table) in connection with that which has been given in table one, seems to prove that the whole oyster area of our State is being rapidly exhausted."

In a paper read before the convention of fishermen of this State at the time of the Exposition, Dr. Brooks says: "The near-sighted policy which the States of Maryland and Virginia have pursued is rapidly leading to the extermination of their natural supply, and the demand for oysters from all parts of our rapidly growing country must be met in some way."

The lower part of the Chesapeake has also suffered greatly, though we have no such accurate and intelligent investigation of the state of affairs there as in Maryland. The fact, however, is generally admitted that the Chesapeake beds are failing, and that no measures at all likely to secure a recuperation have been adopted. The effect of a failure of the Chesapeake industry will, necessarily, be enormous. From that region comes 80 per cent. of the entire oyster crop; over 39,000 persons and \$7,000,000 of capital are employed; many of these people and



much of this capital will be left in idleness as the supply diminishes, and, if the opportunity is offered, there is no reason to doubt that a large proportion of both money and persons will find a resting place in the eastern section of this State. Indeed, already are many inquiries made and much interest manifested in the probable course of North Carolina in relation to its oyster industry. Here then is indicated not only the advisability of extending the present area of oyster ground, but the necessity of taking action at once. In the words of Dr. Brooks on this very subject, "I therefore wish to impress upon you the fact that now is the opportunity which may never come again."

Recognizing the advisability, if not the necessity, the question is how to bring about the desired end. My opinion on this subject was formed many years ago and has been urged persistently ever since its formation. The course of events and recent experiences have confirmed rather than disturbed that opinion, and I unhesitatingly assert that an improvement of the oyster industry, an extension of the productive oyster area and increased prosperity of those in any way connected with the business can only be accomplished by granting indefeasible, proprietary rights to those who embark capital, energy and intelligence in these enterprises. I have no desire, however, to speak *ex-cathedra*, and I quote from various publications relating to oyster growing localities in order that every reader may judge for himself as to the correctness of my conclusions.

In 1858 M. Coste, an eminent French scientist, began the replenishing of the exhausted beds on the coast of France. His methods were entirely similar to those adopted by myself in making the experiments in Bogue and Pamlico Sounds. Shells and bundles of twigs were exposed for the attachment of the young oysters; and like my own experiments, the operation was entirely successful. Farms were then established and an area of 1,000 acres of land restocked. In 1863, on only one half of this restocked ground, 16,000,000 oysters were taken during six low tides, and land ceded by the government and similarly handled produced like, if not greater results.

In a report to the Minister of Marine, on the Condition of Oyster Culture, made by M. de Bon, in 1875, he says: "Private industry followed the impulse given by the State. On the coasts of Normandy and Brittany, on those extending from the Loire to the Gironde and in the basin of Arcachon, concessions were solicited from the Minister of Marine; oyster parks were established, and the people engaged with eagerness in experiments at artificial reproduction. Capitalists intrusted their funds to enterprises of this kind, conceived on a grand scale. The success in several localities was very marked. In the beginning of 1861, M. Coste \* \* \* \* \* stated that the bay of Saint-Brieuc, where the first experiments had been made, could immediately furnish a harvest of several millions of marketable oysters; that the coasts of the Island of Re had been converted into a vast and richly stocked oyster bed; that the basin of Arcachon promised a harvest of incalculable richness; that in the roadsteads of Brest and Toulon the success attained, although less pronounced, was still of a nature to justify the most sanguine hopes," &c., &c. In another part of his report, M. de Bon says: "Requests for concessions of parks are being received by the Minister of Marine from all quarters of the coast. Attempts are being made to reconstruct old and abandoned establishments, while new ones are being started in the majority of localities where others formerly existed." In another part of this same report M. de Bon states that at Arcachon, in 1871, the parks (oyster grounds) controlled by private parties numbered 724 and occupied 1,450 acres. In 1872 they numbered 1,133 and occupied 2,625 acres, and in 1874 the number had risen to 1,706 and the acreage to 4,310. In 1875 there were 6,625 acres under cultivation.

In England private individuals or companies have generally been successful in cultivating oysters, and have both extended the area and increased the supply. I regret that I have not at hand the statistics of the operations along the English coast, as the success of the Whitstable and South of England companies is most instructive, and the Dutch and Italian experiences are equally valuable.

I have quoted already some of the records of foreign oyster fisheries to show how destructive had been the influence of excessive fishery. But notwithstanding the almost complete annihilation of the foreign beds, Mr. G. Brown Goode, Assistant Director of the National Museum and United States Commissioner at the London Fishermen's Exhibition, says that the European oyster crop is over 2,170,000,000 oysters. But he also says *that 2,000,000,000 of this product is produced by private artificial beds.*

Turning to our own country, we have still more remarkable instances of the effect of permitting private enterprise to enter in this field. As already stated, there is not a State north of this that has not seen the impairment or destruction of its oyster industry; but, so far, only two States have recognized that to secure recuperation that most powerful of motives, self-interest, must be called into action. As might be supposed, those States are Rhode Island and Connecticut, already proverbial for their shrewdness.

In 1865 Rhode Island adopted a law which practically allowed individuals to take up unlimited tracts of bottom and secured to them its possession. The effect of this measure has been unqualifiedly good, and I quote from the Report of the Maryland Oyster Commission some of the principal results which have followed upon this sensible action of the State:

"The price of oysters has decreased, and the supply has become so abundant that only one-tenth are needed for the home market, and nine-tenths of the annual supply is sold outside the State.

"In 1865, oysters sold for \$1.75 per solid gallon; in 1878 the price was \$1.15 to \$1.10, and in 1879 it had fallen to 90@95 cents.

"In 1865 the product of the State was 71,894 bushels, while in 1879 it was 660,500 bushels.

"The area which was used for planting in 1879 was only 962 acres, yet this area paid \$6,582.90 into the State Treasury; it employed a capital of over \$1,000,000; it paid \$125,000 in wages to the people of the State; it furnished the market with

660,500 bushels of oysters, worth \$680,500, to the producers, and it gave support to 2,400 persons.

"The following table gives the revenue of the State from the rent of the beds for each year, from 1865, when the present method was adopted, up to 1878, and also in 1882 and in 1883:

1865,	.	.	.	.	.	.	.	.	\$	737.32
1866,	.	.	.	.	.	.	.	.		661.27
1867,	.	.	.	.	.	.	.	.		1,568.50
1868,	.	.	.	.	.	.	.	.		1,814.40
1869,	.	.	.	.	.	.	.	.		1,946.15
1870,	.	.	.	.	.	.	.	.		1,527.65
1871,	.	.	.	.	.	.	.	.		2,186.63
1872,	.	.	.	.	.	.	.	.		2,772.95
1873,	.	.	.	.	.	.	.	.		4,483.88
1874,	.	.	.	.	.	.	.	.		4,997.05
1875,	.	.	.	.	.	.	.	.		5,276.00
1876,	.	.	.	.	.	.	.	.		5,300.00
1877,	.	.	.	.	.	.	.	.		6,045.25
1878,	.	.	.	.	.	.	.	.		6,582.90
1882,	.	.	.	.	.	.	.	.		9,741.00
1883,	.	.	.	.	.	.	.	.		11,000.00

The area of available ground is comparatively small in Rhode Island and is of unusually good quality. Therefore lots command much higher prices than elsewhere. But notwithstanding the large sum asked for the franchises they are eagerly sought and the artificial beds are constantly, though slowly, increasing.

The experience of Connecticut is still more instructive, and the results obtained are of even greater value. Previous to 1881 Connecticut's oyster policy was similar to that of this State, and, in fact, to that of every State in the Union. The natural beds, comprising an area of about 5,000 acres, were held as common property and were open to all, as they still are; and, following the universal experience, the natural beds were soon, either much impaired or completely destroyed. A rude system of cultivation, more advanced, however, than any in the country at that time, was carried on under the provisions of a law grant-



ing to each member of a family two acres of oyster bottom. The ground in the creeks and rivers was soon occupied, and Lieut. de Broca, an officer of the French navy, who was ordered to investigate the oyster industry in this country, says of New Haven harbor in 1862: "As far as the eye can see the bay is covered with myriads of branches, waving in the wind or swayed by the force of currents. It looks as if a forest were submerged—the tops of the trees only rising above the surface of the water." These myriads of branches were the "good and substantial" stakes of the Connecticut oyster "gardens," and an unqualified nuisance they became in course of time.

The ground in shoal water and sheltered localities having been taken up, and the demand for oysters remaining unsatisfied, additional area had in some way to be secured. The only remaining grounds, however, were remote from the land and in deep water, and it was impossible to cultivate them if the cultivator was confined to a small area. The spirit of the law was consequently evaded by the action of individuals in securing from a large number of persons assignments of their lots. Of course it was in the power of large capitalists or popular men to induce many persons to secure two-acre lots who had no idea of engaging in the business; and for a small sum these lots were transferred to the real operator. This method was practiced extensively just prior to the passage of the present law relating to oysters, and according to the Shell Fish Commission Report the result was a loss to the State Treasury of from \$40,000 to \$50,000.

Those who, prior to 1881, cultivated the deep water tracts and held their property under so insecure a title, procured in such an irregular manner as has been described, had many difficulties to contend with. The insecurity of the title brought with it the attendant evils of depredation and litigation. The rudeness of such surveys as were made, and the doubt as to the precise location of the various lots, had a like effect, and the general insecurity felt, resulted in each cultivator's attempting to make his harvest while he could, and to pay as little out and take as

much in as might seem best for his immediate advantage. For the products of the future he could not and did not care, as there might be no future for him.

Systematic and extensive work could not be expected under such conditions, and though progress was made, it was slow and spasmodic. Finally the inherent evils of the system became too onerous to be borne, and the value to the community of deep water culture, on a large scale, having been made apparent, the Legislature of the State passed an Act in 1881, which is given in Appendix C, and of which the following is a synopsis:

The waters of the State are divided into two districts; one, comprising the waters lying inshore of a line drawn from headland to headland, being left to the jurisdiction of the several coast towns, and the other, lying between the line drawn from headland to headland and the State line, which runs through the middle of Long Island Sound, being under the exclusive control of the State. A board of three commissioners exercise this control on the part of the State, and the board of town commissioners on the part of the towns.

The board of commissioners, known as the "Shell Fish Commissioners," were directed to survey, locate and define the natural beds falling under their jurisdiction. This work has been done; the beds have been defined and mapped, and the Legislature has approved the limits assigned by the commissioners by legislative enactment.

The commissioners are authorized to grant, by written instrument, for a fixed price, perpetual franchises for the fishery of shell-fish upon such areas and tracts as may be applied for, except the natural beds. The course of procedure is as follows: Any person desiring a franchise makes a written application to the commissioners, stating the area and location of the ground desired. A notice containing the name and residence of the applicant, the date of the application and the location, area and description of the ground applied for, is then posted for twenty days in the town adjacent to the ground desired. Any person objecting to the granting of the franchise may file, within twenty

days, such objection, in writing, with the commissioners. The commissioners then, after giving ten days' notice to those concerned, hear testimony and pass upon the application; and having decided to grant the franchise, and upon the receipt of the purchase money, issue a regular deed conveying the right of fishery to the applicant, his heirs and assigns. The engineer of the Commission surveys and locates the ground, the owner paying the cost of the survey. Upon the receipt of the deed and completion of the survey, the owner is required to mark the corners and boundaries of the lots by suitable buoys, or monuments or ranges on shore; to improve the ground within five years and to pay a regular tax determined by the commissioners. All persons have the right of appeal from the decisions of the commissioners to the Courts, and it is highly creditable to the commissioners and excellent evidence of the impartiality and justice of their decisions, that no such appeals have ever been made. All applications, grants and assignments are, in manner and form, as approved by the Chief Justice of the State.

A study of this piece of legislation will convince any one that it is nearly the perfection of sound, practical, common sense. It recognizes the advantage which results to any business from the proprietary principle—a principle to which is owing every advance in the progress of human affairs. It recognizes the fact, already so well established as to need recognition only from a legislative body, that an oyster could be cultivated with the same ease as a potato, and reared with the same facility as a pig or calf. And it acknowledges, which is evident, that the same laws which have been found for centuries to be efficacious in promoting agriculture and stock raising, would have good effect if applied to an industry whose methods were analagous to both agriculture and the breeding of cattle.

The results have justified every anticipation. Tracts of bottom lying five and ten miles from land, in from twenty to sixty feet of water, on sandy, muddy and rocky bottoms, where gales blow with violence, fogs are thick and ice forms for months at the time, have been taken up, paid for and put under cultivation. Steamers

and sailing vessels are employed winter and summer on the beds; thousands of people are engaged in the many branches of the business where hundreds were at work a few years ago, and finally the State is reaping a rich, direct, pecuniary return in the proceeds of sales and taxes. The following statistics are taken from the several reports of the Shell Fish Commission:

GROUND DESIGNATED WITHIN THE AREA UNDER THE  
JURISDICTION OF THE STATE.

Prior to 1881,	.	.	.	.	.	33,687.9 acres.
1881,	..	.	.	.	.	17,456.2 "
1882,	.	.	.	.	.	6,381.5 "
1883,	.	..	.	.	.	14,907.9 "
1884,	.	.	.	.	.	6,505.7 "
1885,	.	.	.	.	.	613.2 "
1886,	.	.	.	.	.	4,882.1 "
Total,						87,434.5

In addition there is a large area of private oyster ground within the jurisdiction of the towns, so that the total number of acres is probably over 100,000. Of the area controlled by the commissioners 20,714 acres are under cultivation and the rest not yet developed. Under the act (see Appendix C) a considerable portion of this undeveloped area will revert to the State during the coming year unless it is improved.

According to the last report of the commissioners the number of proprietors is 434; of which 96 own 10 acres and under; 40 own over 10 acres and under 26; 148 own over 26 and under 101 acres, and 150 own over 100 acres. "But," say the commissioners, "the best index of growth is the steady enlargement of the steam fleet engaged in the business." In 1884, 31 steamers, with a daily capacity of from 100 to 2,000 bushels, were employed on the beds. In 1886 there are 60 vessels, or double the number at work in 1884.





A review of the foregoing statements shows, that through the adoption of the policy of giving to individuals who cultivate oyster bottoms the same rights, privileges and protection, and holding them under the same obligations that the cultivators of ordinary uplands receive and are exposed to, the State of Connecticut has, notwithstanding the unusual and extraordinary expenses due to installation and work of an entirely new nature, received in five years a direct, net profit of \$32,754.32. Contrast this with the statement of the Maryland Oyster Commission, as to the financial results of the policy adopted in the Chesapeake, which statement is here quoted :

“It will be seen from this table, that while the receipts for the past five years have been the very considerable sum of \$210,332.24, the expenses have been \$217,753.07, or \$7,420.83 more than the revenue.”

And this while the Maryland beds are steadily deteriorating and the Connecticut beds constantly appreciating in value.

While the direct financial return is great to the States that have been liberal and wise in their policy towards the oyster grower, the indirect benefits to the people at large are even of greater value and importance. The statistics of the Rhode Island industry shows that the price of oysters has fallen since the passage of the law, about 50 per cent. As Ingersoll says in his monograph on the oyster industry, “year by year oysters are increasing in quantity and lessening in price.”

The Connecticut Shell Fish Commissioners say : “Every year affords new evidence that the methods adopted by Connecticut for developing and promoting its oyster industries were timely and wise.” And the Chairman of the Commission states that but for the ravages of the star-fish, oysters could be sold for 25 cents a bushel. In 1880 Ingersoll gives the average value per bushel as over \$1.00.

In Rhode Island the industry now gives support to over 2,400 persons. In Connecticut the number has not been estimated, but it must be very large. The 60 steamers will average eight men each for a crew—which would give 480 men employed afloat in addition to the 200 given by the census. I

have myself seen, during the summer, in the employment of one planter 50 men who were engaged "shelling" new ground, and an allowance of 10 men constantly employed, to each planter, would not be an excessive estimate. Even that would give 4,340 persons engaged in the business; and the estimate does not include those who are employed in the shucking and canning establishments, and those engaged on the public grounds, whose number probably exceeds those who are at work afloat or with the crop. It is probably considerably within the limits, to assign 8,000 persons as directly and indirectly connected with the Connecticut oyster industry. In 1879, according to the census, but 1,006 persons were employed.

Wages have risen steadily. In 1879, according to the census and Ingersoll, "shuckers" in New Haven averaged \$20 per month as wages. In 1886, according to Mr. T. S. Hodson, a member of the Maryland Senate, who has recently investigated the Connecticut fisheries, wages had increased to \$2 per day. I quote his own words, and all the more cheerfully as he appears a somewhat unwilling witness to the value of the Connecticut policy. He says:

"It was my privilege during the past week to visit and inspect the oyster industries of New Haven, Ct., and the operations in them. I reached the following conclusions:

\* \* \* \* \*

"8. That the condition of labor has been improved by the new system and its profits increased. More people are engaged in the business and at better prices than before. I could not hear of any man who works there for less than \$2 per day. Women do most of the shucking, and earn from \$1.50 to \$2 per day in the season. They get a great deal more shucking to do now than before—three or four times as much."

My own observation coincides with Mr. Hodson's conclusions.

The Maryland Oyster Commission quotes from a Connecticut writer the following statement, which contains nothing that is untrue and little that is exaggerated:

"Fifty thousand acres of entirely barren ground, covered

thirty, forty and fifty feet deep by the waters of Long Island Sound, have been made into productive oyster beds, and have multiplied by an hundred-fold the production of native oysters. Ten years ago tens of thousands of bushels of oysters were imported from New York, New Jersey and Rhode Island, and now hundreds of thousands of bushels are yearly exported to those States and to Massachusetts. Millions of dollars are now invested in the industry, thousands of men and women are employed, millions of bushels are in growing crops, and hundreds of thousands of dollars yearly come into the State as proceeds of exported oysters. The oyster authorities have paid more than fifty thousand dollars to the towns and to the State for grounds to cultivate, and pay a yearly tax to a large amount."

Finally, in concluding these remarks on the results of the policy in force in Connecticut and Rhode Island, I cannot do better than publish a letter recently received from Judge R. G. Pike, Chairman of the Connecticut Shell Fish Commission, an able lawyer and a man who stands deservedly high in the opinion of his fellow citizens :

MIDDLETOWN, CONN., Oct. 1, 1886.

*Lieut. Francis Winslow, U. S. N.:*

DEAR SIR:—In reply to yours of the 26th ult., I have to-day sent you by mail a complete set of shell-fish reports, which I think will answer all your inquiries fully. The 6th report will be printed and distributed in about a month, and I shall remember to send you an early copy.

After five years' experience, I can confidently assure you that our system has worked admirably. Ownership in the lands encourages the industry: it gives assurance of legal protection to the crop, and stimulates the planter to enter into thorough cultivation of larger areas. But for the havoc made by the *star fish*, oysters would be so abundant that they could be sold for 25 cents a bushel. But you must look into the reports I have sent. They cover all the details of our work. If I can do anything further to aid you, don't hesitate to command me.

I am, very truly, yours,

R. G. PIKE.

The results of treating oyster lands as all other lands are treated may then be summarized as follows:

Prices are decreased; wages are increased; larger areas are put under cultivation; larger numbers of people are employed, and a direct revenue to the State secured or increased.



The effect of an opposite policy has been summed up so thoroughly and ably by the Maryland Oyster Commission that I reproduce their words :

"Our present oyster policy has had a thorough trial, extending over a long term of years, and we may therefore ask now, with perfect propriety, what it has accomplished. We believe that any one who is in a position to view the subject from all sides, or any one who will candidly weigh the facts which are detailed in this report, will acknowledge that the following is a just answer to his question :

"Under our present policy our beds have yielded about ten million bushels of oysters a year from grounds which are capable of yielding over five hundred million bushels annually.

"Our present policy has resulted in the destruction of some of our most valuable beds, and in the serious injury of all of them, while other States have greatly increased the value of their beds at the same time that they increased instead of restricting the fishing.

"It has given employment to about fifty thousand of our people for part of the year, while our grounds should give profitable employment to five hundred thousand people for the whole year.

"It has done nothing to encourage migration into our State, although our natural advantages, if they could be utilized, would draw to us a very desirable class of emigrants.

"It has paid our oystermen about two million dollars a year, although our grounds should pay to their cultivators over sixty million dollars a year.

"Over six hundred thousand acres of oyster ground has paid to the State Treasury about fifty thousand dollars a year, and it has paid about ten thousand dollars a year to the school fund, while the Governor of Rhode Island reports that his State will this year receive a revenue of over eleven thousand dollars from eleven hundred acres of oyster ground, none of which is so

valuable as that of our State. On the same basis our revenue should be more than six million dollars a year.

"The revenue is not only very much less than it should be, but the cost of collecting it is in excess of the receipts."

It rests now with the people of this State to decide which of the two policies they will adopt. It seems incredible that there should exist anywhere any doubt or hesitancy in the matter. Unfortunately, however, such has always been the case, and it is due to several causes. For ages, ignorance of the habits and character of oysters and oyster beds has led to their treatment as common property in the same manner as migratory fish; but the reasons for the treatment of migratory fish as common property will not hold good in the case of the oyster.

It is impossible to confine migratory fish without interference with navigation. Neither can individuals, through their own exertions, care for, protect, increase, or by any possibility secure an equitable title to an individual fish. For this reason fish have always been held in common, and governments and States have expended large sums in the effort to increase and protect the general property. But, says the Maryland Oyster Commission on this subject:

"It is important to bear in mind that the reasons which justify this course do not apply to the oyster industry. The private ownership and cultivation of the oyster bottoms need not interfere in any way with the free navigation of the waters above them, and as the oyster stays where it is put, there is no difficulty in securing to private cultivators the fruits of their own industry."

And again:

"Every one knows that all ordinary business enterprises thrive best in private hands, and that it is extremely difficult for the government to manage with pecuniary success any such undertaking."

Another reason is the belief, until lately prevalent among those who are presumed to know most on the subject, that the ground upon which oysters could grow was very limited. The

experience of the French, Dutch and English oyster culturists, and of the Rhode Island and Connecticut planters, and the surveys and examinations of the U. S. Coast Survey, Fish Commission, and the Johns Hopkins University, together with the studies of Verrill, Brooks, Ryder, Goode, Rice, Luggier and others, have shown that this belief has no foundation in fact, and that the area suitable for oyster culture is, in this country at least, practically unlimited. A third reason for the long continuance of the generally senseless policy regarding oyster beds is the ignorant and unreasoning opposition of the oystermen, who, of all people, are the most to be benefited, and who, experience proves, have received, proportionately, the largest amount of good from the change in policy. In all States, however, the few thousand people engaged in fishing the natural beds have cried out against any change from their wasteful and destructive methods, and their influence has usually been too powerful to permit the adoption of a policy which would double their daily wages.

This outcry is due to the impression, often widespread, that some one proposes to occupy the natural beds; whereas no intelligent cultivator would touch a natural bed, and no State has ever yet or ever will permit their absorption by individuals. Another favorite cry is that of "monopoly." But a monopoly can hardly be accomplished when the area of suitable bottom is practically unlimited, and there is no more reason to apprehend a monopoly of oyster land than of any other, provided the same laws govern both, as they can and should do. Indeed, if any monopoly exists, it is vested in the oystermen themselves, who alone have the use of and reap the profits from property which nature has given, not to them, but to the community at large. And so badly have they cared for that which they assumed to own and control, that the 300,000 acres of the Chesapeake are well nigh destroyed. It affords me much pleasure, however, to testify here as I have done before, to the almost entire absence, in the case of the North Carolina fishermen, of this feeling against cultivation or ownership of oyster

ground ; and it is greatly to their credit that so little bigotry and prejudice exists among them.

Dr. Brooks, Dr. Gill, Mr. G. Brown Goode, the Connecticut Shell Fish Commissioners, the Rhode Island Shell Fish Commissioners, the Fish Commissioner of New York, the Oyster Commission of Maryland, the U. S. Fish Commission, the American Fish Cultural Association and many other eminent authorities, commissions and bodies at home and abroad, have advocated the application of the general laws governing property to the oyster interests.

The Maryland Oyster Commission says in relation to planting: "It is capable of supporting a very great population ; but no great growth of the planting industry can be hoped for until private enterprise in this direction is rendered as safe as similar investments of labor and capital on land." And the following is their conclusion as to the policy Maryland should adopt :

"We have given careful attention to the possibility of artificially increasing the supply, and we have availed ourselves of all sources of information, and have studied the laws and methods which have been found effective in Europe and in other States of our own country. \* \* \* \* \*

The adoption by our people of measures which are already employed with advantage by other communities, would increase the wealth and prosperity of Maryland almost beyond computation, and would add to the value and fertility of our oyster grounds in the same way that our farming lands have increased in value since the time when they were uncultivated hunting grounds. This can be brought about only by bringing the industry and intelligence of man to the assistance of nature, and at present there is little opportunity for enterprise in this direction in Maryland, and our oyster property owes none of its value to human industry, although there are in our State no farming lands which would yield a more sure and ample return for invested capital and labor. We therefore believe that a complete change must be made in our oyster policy before our people can reap the full benefit of their natural advantages."



The Connecticut commissioners say: "The laws granting a perpetual license of the grounds at trifling cost—the clearing up of titles—the adjustment of boundaries and the protection of growing crops, these have placed the business of cultivating upon a basis that inspires confidence and encourages effort."

Mr. Goode says in his address delivered in London, England, on the fisheries of the United States:

"The preservation of the oyster beds is a matter of vital importance to the United States, for oyster fishing, unsupported by oyster culture, will, within a short period, destroy the employment of tens of thousands, and the cheap and favorite food of tens of millions of our people.

"Something may be effected by laws which allow each bed to rest for a period of years after each season of fishing upon it. It is the general belief, however, that shell-fish-beds must be cultivated as carefully as garden beds, and this can only be done by leasing them to individuals. This is already the practice in the Northern States, where oysters are planted in new localities; there is difficulty, however, in carrying out this policy in the case of natural beds, to which the fishermen have had continued access for centuries. It is probable that the present unregulated methods will prevail until the dredging of the natural beds ceases to be remunerative, and that the oyster industry will then be transferred from the improvident fishermen to the care-taking oyster culturists."

And again, before a meeting of the Fish Cultural Association, Mr. Goode says:

"I have been looking into the history of the oyster industry of Europe lately, and am convinced that Connecticut is putting into practice the best system of oyster culture in the world."

At a meeting of the American Fish Cultural Association, held in Washington in May, 1884, a strong resolution was adopted, urgently advising that the principle of proprietary rights should be extended to the oyster fishery, as the only measure which would avert the impending destruction of the industry.

In the New York *Commercial Advertiser* of Dec. 28, 1886, I find the following statement of Mr. E. G. Blackford, Fish Commissioner of New York, and probably the most prominent fish and oyster dealer in the country :

"This winter I shall recommend the encouragement of the planting of artificial beds of oysters by the adoption of a law similar to that now in force in Connecticut, creating a shell-fish commission. The great drawback to artificial cultivation in this State has been the uncertainty of tenure of the beds. The Connecticut law grants a perpetual franchise of the oyster grounds, the buyer controlling them, as long as he will improve the grounds and pay a small tax on them. The total receipts of such tax is used to protect the oyster interests of the State. Under this law more than 100,000 acres have been taken up by planters in Connecticut and the annual product of the State has increased more than 300 per cent. in six years. Rhode Island's similar law has worked benefits as great to that State. Eleven thousand acres are now in cultivation there. The system of giving absolute deeds, all oyster experts agree, is the only practicable solution of the oyster raising problem. Security of tenure must be given the planter before the cultivation of private beds can reach the fullest and most profitable development. I shall recommend the passage of the act I speak of very soon. The enactment of such a law will give the necessary security of tenure, increase the State revenue, realize more than \$300,000 from unused lands, and put upon a solid and permanent basis what may become one of the most important industries of the State. Liberal laws which will promote this industry are what it needs."

Quotations of opinions and citations of results might be continued indefinitely, but enough has been stated to show, not only the inherent merits and justice of the policy advocated and the emphatic endorsement it has everywhere received from intelligent and capable men, but also the great and beneficial effects which have followed its adoption.

I have shown that an enormous area of barren and unproductive bottom in North Carolina is capable of considerable development. If its development is permitted, I believe that in the course of a few years large capital and many people will be employed in the eastern portion of the State, and a section of the country that has waited a century for prosperity to spring from the land will at last find it in the depths of the water. But I would also most strongly impress my opinion, and it coincides with that of every other authority, that neither development nor prosperity can possibly be achieved unless the oyster culturist is granted the same privileges and afforded the same protection that are insured to enterprise, persons and capital in every other field of exertion.

#### RECOMMENDATIONS.

In the foregoing pages the general condition of the natural and artificial oyster beds has been stated, together with the various sources of dissatisfaction. A remedy, in general terms, has been suggested, and a course of policy advocated. Summing up the results in the several branches of the inquiry and the information obtained, it is evident that :

The natural beds are deteriorating, principally through over-fishery and want of intelligent supervision.

That the area of artificial beds has not been extended in proportion to the demands of the general market, nor to the area suitable for cultivation.

That this want of progress is due to the indefinite description of the areas exempted from entry ; to the limitation of the oyster farmer to small and inadequate tracts, and to the insecurity of titles.

That the necessity for maintaining " stakes " interferes to some extent with the right of fishing for migratory fish and with free navigation, and that it is impossible to maintain such stakes in the deep and open waters of the Sounds in which the most desirable grounds are situated.

That a large area within the State is suitable for oyster culture, and that it has not and cannot be developed under the existing laws.

To cure these defects and remove the obstacles which lie in the road to the establishment of the industry upon a firm and just foundation, I suggest that the following recommendations be incorporated in a new enactment by the Legislature :

1st. That the control of the shell-fish interests of the State be committed to some body, which shall be large enough to enable it to exercise the semi-judicial functions which its duties will entail, and yet sufficiently small to secure executive qualifications and full responsibility.

2d. That, as the entire area of the waters of the State has not yet been surveyed or examined and as the areas and positions of all the various natural oyster beds have not yet been determined, the several sections defined in the first part of this report be accepted and made legal divisions of the area. The sections have been laid off with a view to their possible utilization in this way. They begin and end at points established with all the accuracy of the most accurate surveyors in the world—the officers of the U. S. Coast Survey; and their limits are therefore clearly and sharply defined. In many the surveys have been completed, and by adopting these or similar divisions, portions of the area may be opened to entry from time to time as the natural beds are located, and thus an immediate revenue secured and a portion, if not all of the expenses attending the installation of the work, be defrayed. The action will be similar to laying off a town in blocks and permitting building in each as fast as the grades are established and public ways defined.

3d. That the body controlling the shell-fisheries, after suitable surveys have been made and the positions of the natural beds defined and laid down on proper maps, shall determine upon the areas and positions of the public grounds of the State, in each section.

4th. That the public grounds shall include all natural beds and such adjacent area as may be necessary to provide for such natural



expansion as would occur within a reasonable time, and that a definition be given to the term "natural bed."

5th. That the body controlling the fishery shall have full power and jurisdiction over the public grounds, and shall prescribe such rules and regulations for the government of the same as may be necessary.

6th. That upon the determination of the location and area of the public grounds, in any section, the same shall be published for the information of those whom it may concern, and that opportunity to be heard be given any person who is dissatisfied with the decision as announced; and that all objections and protests shall receive consideration, and be substantiated or refuted, if necessary, by additional surveys and examinations.

7th. That the body controlling the fishery, after being fully satisfied as to all the facts in the case, shall come to a final decision, which shall be binding upon all persons until reversed by due process before the courts to which appeals shall lie.

8th. That the body controlling the fishery, after having determined the positions and areas of the public grounds, shall have power to grant perpetual franchises for the fishery and cultivation of shell-fish, on any area not within the boundaries of the public grounds.

9th. That the Legislature determine upon a certain fixed price per acre to be paid, and that upon its payment the applicant for ground shall be entitled to his franchise.

10th. That the body controlling the shell-fishery shall furnish each owner of ground with a survey, plot and description of his lot for the actual cost of making the same, and shall prescribe the place, character and number of stakes, buoys or monuments or ranges which the owner shall maintain, so that there shall be no interference with navigation or the fishery of migratory fishes.

11th. That all holders of licenses under the present statute, who have complied with the law, shall obtain from the body controlling the fisheries franchises for their grounds, and that the surveys and locations of the same shall be verified before issuing such franchises.

12th. That a regular tax be levied and collected on all private grounds in the same manner as upon other property.

13th. That any private ground which is not improved within five years shall revert to the State.

14th. That forms for all applications, grants, assignments and protests be determined upon by some competent authority and be adopted for use.

15th. That regular books of record and plats of the grounds shall be kept by the body controlling the fisheries and that all grants, transfers and assignments shall be therein recorded.

These suggestions are general in character and of course admit of elaboration as may be deemed best. They provide for intelligent supervision of the whole industry, for the opening of the undeveloped area, for the maintenance of the rights of individuals and of the public, and insure even justice to all. They contain the essential features of the Connecticut law, which has passed beyond the domain of experiment, and their adoption by this State will, I believe, bring about great benefits, and will not, I know, result to the detriment of any one.

The course to be pursued is for the people of the State to determine. There is a tide in the affairs of communities as well as of individuals which taken on the flood leads to prosperity, and I believe that an opportunity is now offered which may never occur again; that between the destruction of the great Chesapeake natural beds and the establishment of equally great and more valuable private grounds in the same locality, there is an opening which can be utilized to overwhelming advantage.

If but one-tenth the area in this State which is suitable for oyster culture is developed, it will necessitate the employment of \$1,200,000 capital, the production of over forty times as many oysters as the State now yields, and the return of a gross income exceeding \$2,000,000 per annum. Surely the attainment of such results is worthy of unflagging pursuit and strenuous effort. Certainly if they can be secured by so simple an act as granting fair protection and justice to the oyster farmer, there should be no hesitancy in accomplishing it.

## APPENDIX A.

TABLE SHOWING THE LOCATION AND AREA OF THE PRIVATE OYSTER LOTS ESTABLISHED UNDER AUTHORITY OF SECTION 3390 OF THE CODE.

## DARE COUNTY.

TOWNSHIP.	NAME.	NO. OF ACRES.		REMARKS.
		BY LICENSE.	BY SURVEY.	
Roanoke Island.	Ballance, H. G.....	10	.....	Deficient description.
"	Daniels, C. S.....	10	8.67	
"	Daniels, S. M.....	10	8.67	
"	Dutton, J. T.....	10	.....	Deficient description.
"	Daniels, E. R.....	10	8.67	
"	Daniels, T. W.....	.....	8.26	
"	Daniels, G. C.....	10	.....	Deficient description.
"	Etheridge, A. M.....	10	8.67	
"	Etheridge, J. B.....	.....	7.54(?)	Error in survey.
"	Farrow, C. B.....	.....	9.91	
"	Greene, E. C.....	10	6.26	
"	Garrison, J. T.....	10	5.59	
"	Hooker, S.....	10	6.97	
"	Johnson, C. C.....	10	8.67	
"	Meekins, W. L.....	10	8.67	
"	Meekins, B. F.....	10	10.09	
"	Meekins, J. C.....	10	.....	Deficient description.
"	Peigh, L. J.....	10	8.67	
"	Peigh, W. S. C.....	10	8.67	
"	Stetson, T.....	10	8.67	
"	Tillette, L. R.....	10	8.67	
"	Wise, J. H.....	.....	6.1	
Croatan.....	Grant, James.....	10	10.12	
Croatan.....	Lamb, E. F.....	10	10.02	

## HYDE COUNTY.

Lake Landing.	Clayton, W. P.....	.....	2.46(?)	Error in survey.
"	Cutrell, J.....	2	.....	Deficient description.
"	Cox, J. F.....	0.5	0.72(?)	Error in survey.
"	Daniels, J. C.....	10	.....	No description.
"	Godley, B. F.....	.....	.....	"
"	Grimes, B.....	.....	.....	"
"	Gibbs, N. S.....	0.75	.....	"
"	Gibbs, R. J.....	7.5	.....	Wrong description.
"	Grant James.....	10	9.97	
"	Lamb, E. F.....	10	9.87	
"	Mason, J. W.....	2.0	1.95(?)	Description wrong.
"	Mason, C. J.....	4.5	.....	Deficient description.
"	Neal, John, Jr.....	5.9	.....	
"	Neal, Wm. S.....	3.0	2.62(?)	Error in survey.
"	Neal, John G.....	2.75	.....	No description.
"	Rose Jephtha.....	2.0	2.07	
"	Spencer, J.....	2.25	.....	Deficient description.
"	Spencer, S. H.....	10.0	10.61	
"	Swindell, J. V.....	5.25	.....	Deficient description.
"	Spencer, W. B.....	10	.....	"
"	Silby, Talbot.....	5.71	5.49	
"	Vendrick, Jas.....	.....	.....	No description.
"	Watson, J. B.....	8.47	9.54	
"	Midgett, L. S.....	.....	.....	No description.

## CARTERET COUNTY.

TOWNSHIP.	NAME.	NO. OF ACRES.		REMARKS.
		BY LICENSE.	BY SURVEY.	
Hunting Quarters.	Abbott, J.....	10	9.55	
"	Daily, W. M.....	10	9.50	
"	Dixon, E. G.....	10	10.01(?)	Error in description.
"	Dixon, G.....	10		Deficient description.
"	Day, John.....	10	9.37	
"	Day, S.....	10		Deficient description.
"	Enery, S.....	10		"
"	Fulcher, J.....	6		"
"	Fulcher, A. M.....	10		"
"	Fulcher, E. L.....	6		"
"	Fulcher, R.....	10	8.79	
"	Fulcher, Wm.....	3		Deficient description.
"	Fulcher, J. W.....	3		"
"	Fulcher, Wallace.....	10	8.46	
"	Gilgo, J. W.....	10		Deficient description.
"	Gaskill, J. W.....	10		"
"	Gaskill, E. P.....	10		"
"	Gaskill, J. S.....	10		"
"	Gaskill, T. T.....	10	10.62	
"	Gaskill, J. A.....	10	10.62	
"	Gaskill, R.....	10		Deficient description.
"	Gaskins, T.....	10	7.3 (?)	Error in survey.
"	Gaskins, B.....	10		Deficient description.
"	Goin, James.....	10	9.4	
"	Hill, Geo.....	8		Deficient description.
"	Homan, W., Jr.....	10	5.61	
"	Hamilton, A.....	10	9.09(?)	Error in survey.
"	Hamilton, W.....	10		Deficient description.
"	Hamilton, F.....		9.69	
"	Hamilton, G. W.....	9		Deficient description.
"	Hill, Wm.....	10	8.73	
"	Hill, Chas.....	7		Deficient description.
"	Hamilton, I.....	10	9.96	
"	Hamilton, J. W.....	10	9.96	
"	Hamilton, J. N.....	10		Deficient description.
"	Lupton, Silas.....	10	10.48(?)	Error in survey.
"	Lupton, C.....	10	9.6	
"	Lupton, J. J.....	6		Deficient description.
"	Lupton, J. A.....	10	10.12	
"	Lupton, W. B.....	20	18	
"	Lupton, W. O.....	10		Deficient description.
"	Lupton, F. M.....	10		"
"	Lupton, Jas.....	10	8.1	
"	Lupton, M. J.....	10		Deficient description.
"	Lupton, S. F.....		7.65	Error in survey.
"	Lupton, C.....	10		Deficient description.
"	Lupton, J. W.....	10	8.85	
"	Lupton, B. C.....	6		Deficient description.
"	Lupton, S. S.....	10	8.28	
"	Lupton, Jos.....	10		Deficient description.
"	Lupton, W. H.....	10	9.75	
"	Lewis, Wilson.....			No description.
"	Lewis, G.....			
"	Lewis, F.....	10		Deficient description.
"	Lewis, Willis.....			
"	Lewis, Alex.....	10	9.37	
"	Lewis, J. E.....	8.5	6.77	
"	Lewis, J. W.....	9.75	9.84	
"	Mason, K.....	10	9.6	
"	Mason, C.....	10	9.2	
"	Mason, S.....	10		Deficient description.
"	Mason, J.....	10		"
"	Mason, A. W.....	10		"
"	Mason, L.....	8	5.98(?)	Description wrong.



## CARTERET COUNTY—(CONTINUED).

TOWNSHIP.	NAME.	NO. OF ACRES.		REMARKS.
		BY LICENSE.	BY SURVEY.	
Hunting Quarters.	Mason, S. B.....	10		Deficient description.
"	Mason, G. D.....	10	11.46	Error in survey.
"	Morris, J. L.....	8		Deficient description.
"	Pike, L.....	10		"
"	Hamilton, S. E.....	10	9.8	
"	Roberts, J. A.....	10	9.9	
"	Roberts, G. W.....	10	9.91	
"	Robinson, U.....	10	9.9	
"	Rose, G.....	10		Deficient description.
"	Robinson, M.....	10	9.69	
"	Robinson, Thos.....	10		Deficient description.
"	Rose, J. A.....	10	9.28	
"	Styron, S. H.....	10		No description.
"	Styron, R.....	10		Deficient description.
"	Salter, T.....	10		"
"	Styron, W. D.....	10		"
"	Salter, E.....	5	4.39	
"	Styron, R.....	5	4.68(?)	Error in description.
"	Smith, W.....	10		Deficient description.
"	Willis, B.....	10	12.7 (?)	Error in survey.
"	Williams, Wm.....	10		Deficient description.
"	Willis, T.....	10	9.84	
"	Willis, J. S.....	5	4.99	
"	Willis, C.....	5	4.68(?)	Error in description.
"	Williams, J.....	10		Deficient description.
Smyrna.....	Davis, A. F.....	10	9.53	
"	Davis, J. D.....	10	10	
"	Davis, A.....	10	10	
"	Fulford, A. W.....	9.31		Deficient description.
"	Frisbie, H. E.....	10	10	
"	Frisbie, H. L. C.....	10	10	
"	Frisbie, J. A.....	10	10	
"	Frisbie, H. A. E.....	10	10	
"	Frisbie, H. A. M.....	10	10	
"	Frisbie, H. E.....	10	10	
"	Frisbie, D. F.....	10	10	
"	Jones, David.....	3.5		Deficient description.
"	Harker, Samuel.....	10.0		"
"	Pigott, J. N.....	2.90	2.8(?)	Error in survey.
"	Robinson, J. W.....	10	9.66	
"	Robinson, T. W.....	5	8.87	
"	Hamilton, T.....	5		
"	Willis, C.....	3	2.8	
"	Willis, D.....	5.5	6.2	
"	Willis, E. S.....	4.9	4.5	
Straits.....	Fulford, A. B.....	10	9.16	
"	Gaskill, A. H.....	10	10.5(?)	Error in survey.
"	Gaskill, J. D.....	4	4	
"	Leffers, R.....	10		Deficient description.
"	Lewis, N.....	10	10.13	
"	Lewis, Jno. W.....	10	8.68	
"	Moore, T.....	10	7.84	
"	Moore, S.....	10	8.06	
"	Moore, J.....	10	8.24	
"	Moore, E.....	10	9.09	
"	Moore, J. W.....	8	7.19(?)	Error in description and
"	Moore, A.....	8.5	8.6	plot.
"	Pigott, D.....	10	8.29	
"	Pigott, C.....	10	10.8	
Morehead.....	Oglesby, A. E.....	10		Deficient description.
"	Styron, J. F.....	9.7	9.8 (?)	Error in survey.
Beaufort.....	Avery, J. T.....	10	9.96	
"	Buckman, S. M.....	10	9.6	
"	Buckman, —.....	5		Deficient description.
"	Dill, J. A.....	10	10.41(?)	Error in survey.

## CARTERET COUNTY—(CONTINUED).

TOWNSHIP.	NAME.	NO. OF ACRES.		REMARKS.
		BY LICENSE.	BY SURVEY.	
Beaufort.....	Charlott, G. W.....	10	.....	Deficient description.
"	Dickinson, C. L.....	10	9.6	"
"	Dill, W. F.....	10	.....	Deficient description.
"	Dudley, J.....	10	0.9 (?)	Description doubtful.
"	Evans, Belcher.....	10	.....	Deficient description.
"	Fulcher, L. C.....	8	.....	"
"	Gillikin, J. W.....	10	9.6	"
"	Gibbs, E. W.....	10	.....	Deficient description.
"	Gibbs, L.....	10	9.93	"
"	Gibbs, T. R.....	10	.....	Deficient description.
"	Hatsell, W. F.....	6.5	.....	"
"	Hatsell, G. A.....	6.5	8.1	"
"	Ives, G. N.....	6.5	.....	Deficient description.
"	Jones, J. B.....	10	.....	Wrong description.
"	Jones, B. L.....	10	9.93	"
"	Lewis, W. C.....	10	10.5 (?)	Error in survey.
"	Lewis, A.....	5	.....	Deficient description.
"	Lewis, J. B.....	10	.....	"
"	Mace, F. B.....	10	7.22(?)	Error in survey.
"	Potter, L. A.....	6.5	.....	Deficient description.
"	Potter, J. H.....	6.5	8.1	"
"	Pigott, L.....	10	9.72	"
"	Piver, E.....	10	10.21(?)	Error in survey.
"	Pigott, Sandy.....	1.5	.....	Deficient description.
"	Pritchard, G. W.....	10	9.96	"
"	Russell, J. B.....	20	20	"
"	Russell, D. W.....			"
"	Russell, Wm.....			"
"	Russell, T. B.....			"
"	Russell, G. A.....	10	.....	Deficient description.
"	Simpson, J.....			"
"	Simpson, D. E.....			"
"	Simpson, S. L.....			"
"	Taylor, N. W.....	10	9.6	"
"	Taylor, E. W.....	10	9.34	"
"	Thomas, C. R.....	10	.....	Deficient description.
"	Taylor.....	5	.....	"
"	Thomas, Thos.....	10	.....	"
"	Thomas, A.....	10	.....	"
"	Thomas, T. M.....			"
"	Thomas, S.....			"
"	Wade, E.....			"
White Oak.....	Bell, N. P.....	8	.....	"
"	Bell, W. S.....	10	3.18	"
"	Bell, R. C.....	9	.....	Deficient description.
"	Bell, W. C.....	9	.....	"
"	Garner, J. C.....	10	.....	"
"	Garner, D. J.....	10	.....	"
"	Taylor, B. F.....	9	.....	"

## APPENDIX B.

## LAWS OF NORTH CAROLINA RELATING TO OYSTERS.

Sec. 3375. Penalty for using other instruments except tongs to take oysters, unless, &c. R. C., c. 81, s. 3, 1822; c. 1134, s. 4, 1883; c. 116, c. 203.

If any person whatever shall use any drag, or other instrument, except such tongs as are generally used for catching oysters within any of the waters of the State, the person so offending shall forfeit and pay one hundred dollars: *Provided*, the owner or tenant of any private oyster ground may use any scoop, drag, or other instrument, to take oysters therein. *Provided further*, in the waters of Pamlico and Roanoke Sounds no person shall use any drag or other instrument in less than eight feet of water, except such tongs as are generally used for catching oysters.

Sec. 3389. Offences herein created, indictable. R. C., c. 81, s. 13.

Every person who shall take live oysters from the water to be burned into lime, or who shall commit any of the offences in this chapter created, shall be guilty of a misdemeanor.

Sec. 3390. Inhabitant of State authorized to make oyster beds under license. 1883, c. 332, ss. 1, 2.

Any inhabitant of this State may make a bed in any of the waters of this State and lay down or plant oysters or clams therein, having first obtained license, as hereinafter directed, from the Superior Court Clerk of the county wherein such bed may be, and he may stake out the grounds, so as to include not exceeding ten acres, with good and substantial stakes, extending at least two feet above high water mark, and placed at such intervals as to make the boundaries of such bed or garden distinctly known; and every person who shall obtain such license shall hold the same, and have exclusive privilege thereof to him, his heirs and assigns. But no person may have more than one such bed in the same county. *Provided*, nothing herein shall be construed to affect the rights of any owner or proprietor of lands in which there may be creeks or inlets, or which may be adjacent to any navigable waters, or to authorize any person to appropriate to his own use, or to stake off and enclose any natural oyster or clam bed, or in anywise to infringe the common right of the citizens of the State to any such natural bed, or to obstruct the free navigation of the waters aforesaid.

Sec. 3391. Clerk of Superior Court to grant licenses. 1883, c. 332, s. 3.

The Clerks of the Superior Courts may, in their discretion, grant license to make such oyster or clam bed to any inhabitant of this State who shall make application in writing, describing particularly the place whereon he desires to make such bed.

Sec. 3392. County Commissioners to cause surveys to be made, &c. 1883, c. 332, s. 4.

The Board of County Commissioners may, in their discretion, cause to be made, not oftener than once in twelve months, a survey and examination of any or every

such oyster or clam bed or garden in their county, the result of which examination or survey shall be reported under oath to the Clerk of the Superior Court and if it be found that the holder of such license as aforesaid has included within his stakes any natural oyster or clam bed, or a space containing more than ten acres, he shall forfeit such license, and all the rights and privileges thereto belonging; further, if the holder of such license fail for the space of two years either to use such bed or to keep it properly designated by stakes he shall forfeit such license and all the rights and privileges therein granted.

Sec. 3393. Penalty for injuring beds; misdemeanor. 1883, c. 332, s. 5.

If any person shall do any injury to such beds or to the stakes thereof, or shall gather or take away any oysters or clams within the lines of the stakes aforesaid, without permission first had from the owners thereof, he shall forfeit for each offence the sum of ten dollars, and if any person shall commit any such offence in the night time, he shall forfeit for each offence the sum of twenty-five dollars, and the penalties herein created may be recovered by a warrant before a Justice of the Peace by any person who may sue therefor; and in addition to the penalties already prescribed in this section, such offender shall be guilty of a misdemeanor and fined not exceeding fifty dollars or imprisoned not more than thirty days.

Sec. 3394. To promote the growth of oysters in New River. 1881, c. 46, ss. 1, 2.

No person shall remove oysters from natural beds in New River, from the fifteenth day of May to the first day of September in each year, and any person violating this section shall be guilty of a misdemeanor and fined not less than twenty-five dollars for every offence.

Sec. 3423. Unlawful to take oysters from Myrtle Grove Sound, when; misdemeanor and proviso. 1883, c. 358, ss. 1, 2.

No person shall take or catch any oysters from Myrtle Grove Sound, from Perrine's or Whitker's Creek to the headwaters of said sound, in New Hanover county, from the first day of May until the first day of September; *Provided*, this section shall not apply to persons taking oysters for their own consumption, and any person violating this section shall be guilty of a misdemeanor, and fined not more than fifty dollars or imprisoned not more than twenty days.

Sec. 3426. Laws prohibiting the carrying of oysters from State by citizens, for sale, repealed. 1883, c. 116, s. 5.

All laws and clauses of laws prohibiting the carrying of North Carolina oysters out of the State, by the resident citizens thereof, for sale, are repealed.



## APPENDIX C.

THE ACT ESTABLISHING THE CONNECTICUT SHELL FISH  
COMMISSION.

Chapter CLX. An Act, Establishing a State Commission for the designation of oyster grounds.

*Be it enacted by the Senate and House of Representatives in General Assembly convened:*

SECTION 1. The State shall exercise exclusive jurisdiction and control over all shell fisheries which are located in that area of the State which is within that part of Long Island Sound and its tributaries, bounded Westerly and Southerly by the State of New York, Easterly by the State of Rhode Island, and North-erly by a line following the coasts of the State at high water, which shall cross all its bays, rivers, creeks and inlets, at such places nearest Long Island Sound as are within and between points on opposite shores, from one of which, objects and what is done on the opposite shore can be reasonably discerned with the naked eye, or could be discerned but for intervening islands. And all shell fish-eries not within said area, shall be and remain within the jurisdiction and control of the towns in which they are located, under the same laws and regulations, and through the same selectmen and oyster committees as heretofore. If a difference shall arise between any town and the commissioners as hereinafter provided for, as to the boundary line between said town and the area to be mapped, said town, by its selectmen, may bring its petition to the Superior Court for the county within which said town is situated, to determine said boundary line, and said Court, upon reasonable notice to the parties, shall hear said petition and appoint a committee to ascertain the facts in such case, and report the same to said Court, and said Court shall thereupon make such order as may be proper in the premises.

SEC. 2. The three fish commissioners of the State now in office, and their suc-cessors, shall also be and constitute a board of commissioners of shell fisheries, and be empowered to make, or cause to be made, a survey and map of all the grounds within said area in Long Island Sound which have been or may be desig-nated for the planting or cultivation of shell fish; shall ascertain the ownership thereof, and how much of the same is actually in use for said purposes; they shall also cause a survey of all the natural oyster beds in said area, and shall locate and delineate the same on said map, which survey and map, when comple-ted, shall not cost a sum exceeding twenty-five hundred dollars, and shall report to the next session of the Legislature a plan for an equitable taxation of the prop-erty in said fisheries, and make an annual report of the state and condition of said fisheries to the legislature, and the said commissioners shall be empowered to appoint and employ a clerk of and for said board, and they shall each give a bond to the State, with sufficient surety, for the faithful performance of their duties, and for the payment to the State Treasurer of all money that may come into their hands under this act, in the sum of two thousand dollars.

SEC. 3. The said commissioners shall also be empowered, in the name and in behalf of the State, to grant by written instruments, for the purpose of planting and cultivating shell fish, perpetual franchises in such undesignated grounds within said area as are not, and for ten years have not, been natural clam or oys-

ter beds, whenever application in writing is made to them through their clerk by any person or persons who have resided in the State not less than one year next preceding the date of said application. The said application and said grant shall be in a manner and form as shall be approved by the Chief Justice of the State, and all such grants may be assigned to any person or persons who are, or who have been, residents of the State for not less than one year next preceding such assignment, by a written assignment, in manner and form approved by said Chief Justice; and said commissioners shall keep books of record and record all such grants and assignments therein, and the same shall also be recorded in the town clerk's office in the town bounded on Long Island Sound within the meridian boundary lines of which said grounds are located.

SEC. 4. When any such application is filed with the clerk of said commissioners, he shall note on the same the date of its reception and shall cause a written notice, stating the name and residence of the applicant, the date of filing the application, the location, area, and description of the grounds applied for, to be posted in the office of the town clerk of town bounded on the said Long Island Sound within the meridian boundary lines of which said grounds are located, where such notice shall remain posted for twenty days. Any person or persons, objecting to the granting of the grounds applied for as aforesaid may file a written notice with the town clerk, stating the grounds of his or their objections, upon the payment to said town clerk of the sum of twenty-five cents, and at the end of said twenty days the said town clerk shall forward all such written objections to the clerk of said commission; and in case such objections are so filed and forwarded the said commission, or a majority, shall upon ten days' notice in writing, mailed or personally delivered to all the parties in interest, hear and pass upon such objections at the town in which such grounds are located as aforesaid, and if such objections are not sustained and the area of ground is not, in the opinion of the commissioners, of unreasonable extent, they may for the actual costs of surveying and mapping of such grounds, and the further consideration of one dollar per acre, paid to the said commissioners to be by them paid over to the treasurer of the State, grant a perpetual franchise for the planting and cultivating shell-fish in such ground or in any part of the same in the manner aforesaid, and where no such objections are made such grants may be made for the consideration hereinbefore named. At all the hearings authorized by this act the said commissioners may, by themselves or their clerk, subpoena witnesses and administer oaths as in courts of law.

SEC. 5. The said commissioners shall, previous to the delivery of any instrument, conveying the right to plant or cultivate shell-fish on any of said grounds, make, or cause to be made, a survey of the same, and shall locate and delineate the same, or cause to be located and delineated, upon the map aforesaid, and upon receipt of said instrument of conveyance, the grantee shall at once cause the grounds therein conveyed to be plainly marked out by stakes, buoys, ranges or monuments, which stakes and buoys shall be continued by the said grantee and his legal representatives, and the right to use and occupy said grounds for said purposes shall be and remain in said grantee, and his legal representatives; *Provided*, that if the grantee or holder of said grounds does not actually use and occupy the same for the purposes named, in good faith, within five years after the time of receiving such grant, the said commissioners shall petition the Superior Court of the County having jurisdiction over the said grounds, to appoint a committee to inquire and report to said Court as to the use and occupancy of such grounds in good faith,

and said Court shall, in such case, appoint such committee, who, after twelve days' notice to petitioners and respondents, shall hear such petition and report the facts thereon to said Court, and if it shall appear that said grounds are not used and occupied in good faith for the purpose of planting or cultivating shell fish, the said Court may order that said grounds revert to the State, and that all stakes or buoys marking the same, be removed, the costs in said petition to be paid at the discretion of the Court.

SEC. 6. When, after the occupancy and cultivation of any grounds designated as aforesaid by the grantee or his legal representatives, it shall appear to said commissioners that said grounds are not suited for the planting or cultivation of oysters, said grantee, upon receiving a certificate to that effect from said commissioners, may surrender the same, or any part thereof, not less than one hundred acres, to the State, by an instrument of release of all his rights and title thereto, and shall, on delivery of such instrument to said commissioners, receive their certificate of said release of said grounds, the location and number of acres described therein, which shall be filed with the State Treasurer, who shall pay to the holder the sum of one dollar for every acre of ground described in said release, where said sum has been paid therefor to the State. And the said release shall be recorded by the said commissioners in their record books, and in the town clerk's office in the town adjacent to and within the meridian boundary lines of which said grounds are located. For all purposes relating to judicial proceedings in criminal matters, the jurisdiction of justices of the peace of the several towns bordering on Long Island Sound shall extend southerly by lines running due south by true meridian from the southern termini of the boundary lines between said towns, to the boundary line between the States of Connecticut and New York.

SEC. 7. Said commissioners shall provide, in addition to the general map of said grounds, sectional maps, comprising all grounds located within the meridian boundary lines of the several towns on the shores of the State, which maps shall be lodged in the town clerk's office of the said respective towns, and said commissioners shall also provide and lodge with said town clerks blank applications for such grounds, and record books for recording conveyances of the same, and all conveyances of such grounds and assignments, reversion and releases of the same shall be recorded in the books of said commissioners, and in the town clerk's offices of the towns adjacent to and within the meridian boundary lines of which said grounds are located, in such books as are provided by said commissioners, subject to legal fees for such recording, and the cost of all such maps, blank books, surveys, and all other expenses necessary for the carrying out of the provisions of this act shall be audited by the comptroller and paid for by the Treasurer of the State, and the said commissioners shall each receive for their services five dollars per day for the time they are actually employed, as provided for in this act; their accounts for such service to be audited by the comptroller, and paid by the Treasurer of the State.

SEC. 8. All designations and transfers of oyster, clam or mussel grounds within the waters of Long Island Sound heretofore made (except designations made of natural oyster, clam or mussel beds), are hereby validated and confirmed.

SEC. 9. All the provisions of the statutes of this State relating to the planting, cultivating, working and protecting shell fisheries upon grounds heretofore designated under said laws, except as provided for in section eight of this act, and as are inconsistent with this act, are hereby continued and made applicable to such designations as may be made under the provisions of this act.



SEC. 10. When it shall be shown to the satisfaction of said commissioners that any natural oyster or clam bed has been designated by them to any person or persons, the said commissioners shall petition the Superior Court of the county having jurisdiction over the said grounds to appoint a committee to enquire and report to said court the facts as to such grounds, and said court shall, in such case, appoint such committee who, after twelve days' notice to the petitioners and respondents, shall hear such petition, and report the facts thereon to said court; and if it shall appear that any natural oyster or clam beds, or any part thereof, have been so designated, the said court may order that said grounds may revert to the State, after a reasonable time for the claimant of the same to remove any shell fish he may have planted or cultivated thereon in good faith, and said court may further order that all stakes and buoys marking the same be removed, the costs in said petition to be taxed at the discretion of the court.

SEC. 11. Any commissioner who shall knowingly grant to any person or persons a franchise as hereinbefore provided, in any natural oyster or clam bed, shall be subject to a fine of not less than one hundred dollars, nor more than five hundred dollars, and if such franchise is granted, the grant shall be void, and all moneys paid thereon shall be forfeited to the State; and said commissioners shall in no case grant to any person or persons a right to plant or cultivate shell fish which shall interfere with any established right of fishing, and if any such grant is made the same shall be void.

SEC. 12. The Superior Court of New Haven county, on the application of the selectmen of the town of Orange, and the Superior Court of any county, on the application of the oyster-ground committee of any town in said county, shall appoint a committee of three disinterested persons of the town within the boundaries of which any natural oyster, clam or mussel beds exist, to ascertain, locate, and describe by proper boundaries all the natural oyster, clam or mussel beds within the boundaries of such town. Said committee so appointed shall first give three weeks' notice, by advertising in a newspaper published in or nearest to said town, the time and place of their first meeting for such purpose; they shall hear parties who appear before them, and may take evidence from such other sources as they may, in their discretion, deem proper, and they shall make written designations by ranges, bounds and areas of all the natural oyster, clam and mussel beds within the boundaries of the town they are appointed for, and shall make a report of their doings to the Superior Court, and such report, when made to and accepted by said court, and recorded in the records thereof, shall be a final and conclusive determination of the extent, boundaries and location of such natural beds at the date of such report. It shall be the duty of the Clerk of the Court to transmit to the town clerk of each of said towns a certified copy of said report so accepted and recorded, in relation to the beds of such town, which shall be recorded by said town clerk in the book kept by him for the record of applications, designations, and conveyance of designated grounds. Such public notice of said application to the Superior Court, and of the time and place of the return of the same, shall be given by said selectmen or oyster-ground committee as any judge of the Superior Court may order. It shall be the duty of the selectmen of the town of Orange, and of oyster committees of other towns, upon a written request so to do, signed by twenty electors of their respective towns, to make such application to the Superior Court within thirty days after receiving a copy of such written request, and said applications shall be privileged, and shall be heard and disposed of at the term of said court to which such application is returned, in preference to other causes. All expenses properly incurred by such



selectmen and oyster-ground committees in said applications, and the doings thereunder, and the fees of said committees so appointed by court shall be taxed by the clerk of said court and paid by the State upon his order. Any designation of ground for the planting or cultivation of shell fish, within the areas so established by such report of said committee, shall be void.

SEC. 13. The selectmen of the town of Orange, and the committees of other towns shall, at the expense of their respective towns, procure and cause to be lodged and kept in the office of the town clerk of each town respectively, accurate maps, showing the boundary lines of their said towns in the navigable waters of the State, and all designations of ground for the cultivation of shell fish, heretofore made, and that shall hereafter be made within such boundaries, and shall number said designations on said maps, and shall cause to be designated on said maps all natural oyster, clam and mussel beds, lying within their several towns respectively, as the same shall be ascertained by said report of said committees so recorded in said towns as hereinbefore provided.

SEC. 14. All acts and parts of acts inconsistent herewith are hereby repealed, but this act shall not affect any suit now pending.

Approved, April 14, 1881.







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